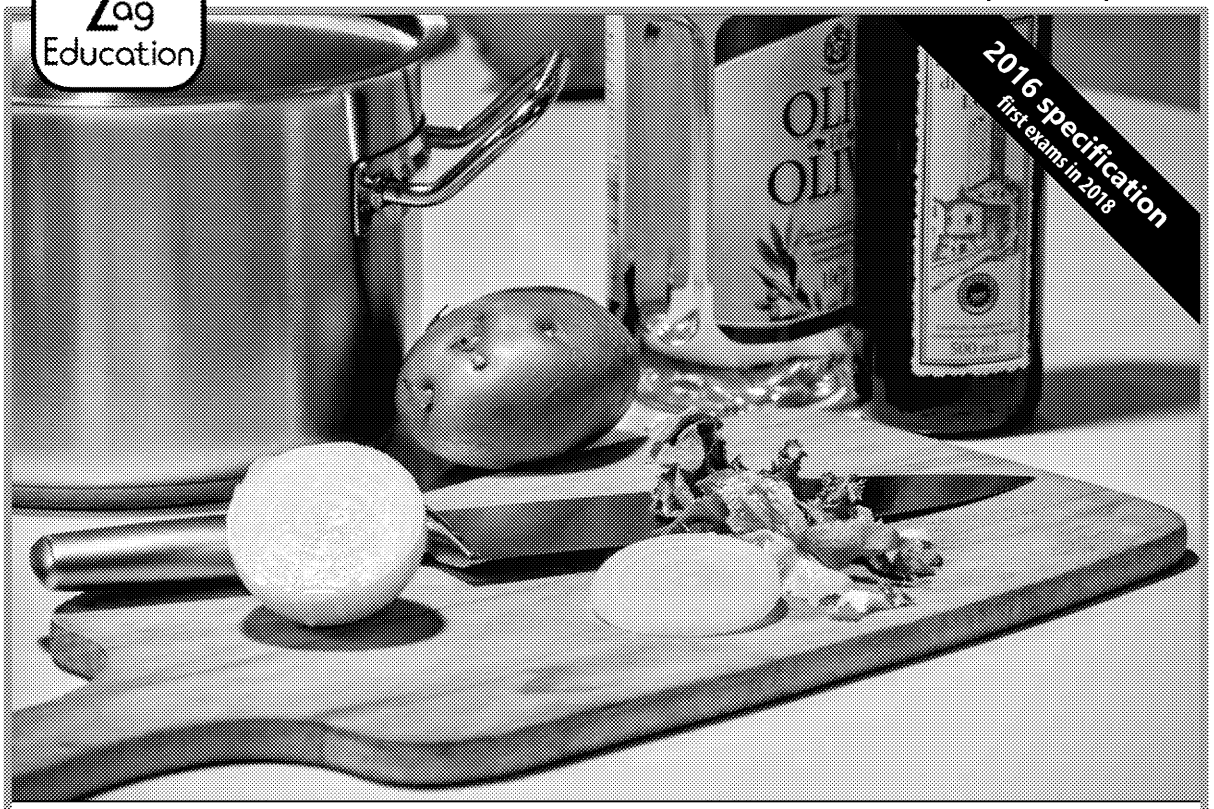
Zig Zag Education

Food and Nutrition GCSE (9–1) | OCR | J309



Course Companion

For GCSE (9–1) OCR Food Preparation and Nutrition

Section C: Cooking and Food Preparation

OCR
Oxford Cambridge and RSA

An OCR endorsed textbook

zigzageducation.co.uk POD 8228

Contents

Teacher's Introduction

This resource is designed to meet the **Section C: Cooking and food preparation** element of the OCR GCSE Food Preparation and Nutrition qualification.

What it covers

The resource comprises three chapters covering the following:

Chapter 1: Food science	**Chapter 2:** Sensory properties	**Chapter 3:** Food safety

• The reasons why food is cooked
• Different methods of heat transfer
• How different cooking methods affect food
• The working characteristics, and functional and chemical properties of cooking ingredients
• **Bonus chapter:** The most common faults in cooking and how to prevent them
	• Sensory evaluation
	• Organoleptic properties of food and sensory systems
	• Sensory testing methods
	• Preference tests
	• Discrimination tests
	• Grading tests
	• Taste panels
		• Microorganisms (food spoilage)
		• High-risk foods
		• Microorganisms (food production)
		• The role of yeast, mould and bacteria in food production
		• Food safety principles when:
		  ○ buying food
		  ○ storing food
		  ○ preparing, cooking and serving food

How to use this resource

The resource covers all aspects of Section C: Cooking and food preparation and is designed to increase knowledge of the topic and enable learners to test their understanding and skills through a variety of assessment methods.

Learning Outcomes enable the learner to clearly see what they are expected to know at the end of each chapter.

The **Overview** provides a brief summary of what will be covered in the chapter and the **Key Terms** box provides information on key terms within the resource (key terms are emboldened within the chapter text).

Did you know	These boxes contain handy tips.
Things to think about	These boxes provide learners with a chance to develop cognitive skills, do some research (books, Internet, people) and take part in a discussion.
Apply	These boxes provide the learner with the opportunity to further their skills, either through cognitive or practical application.
Qs	Learners' knowledge and understanding is tested through quick Y/N questions.
Skills	Based on the suggested application of the skills section (Section D) of the OCR GCSE Food Preparation specification, these test learners' skills in food preparation and cooking through practical application.
Revision tip	Useful tips are given to help the learner concentrate on important aspects that may appear in the final assessment.
Check your understanding	A combination of multiple-choice questions and practice questions appear at the end of each section to test knowledge and understanding.
Quiz-ine	There is a crossword-style quiz at the end of each chapter to test learners' understanding of key terms used within the resource. The shaded squares spell out a word associated with the chapter text.
Answers	Answers to questions are provided at the end of the resource.

Chapter 1: Food scienc

Overview

In this chapter you will learn why we cook food, how heat is transferred to food and how the cooking method can affect the nutritional value and palatability of the dish. You will also discover why and how various ingredients are used in cooking. You will also have a chance to explore why the results are not always achieved, and how to prevent cooking faults.

Learning Outcomes

After studying this chapter you should be able to do the fo

- ❑ identify the main reasons behind cooking food
- ❑ identify foods that cannot be eaten raw and reasons
- ❑ understand how preparation affects sensory charact
- ❑ define what conduction, convection and radiation are
- ❑ know how conduction, convection and radiation work
- ❑ indicate the main processes that take place while co
- ❑ understand the f... and chemical properties o
- ❑ explai... and ...ow certain chemical reactions take
- ❑ ...ate how to prevent or trigger certain reactions
- ❑ identify the main reasons why particular results may situation in such cases

Key Terms

Aeration	The process of incorporating air between fat particle a food mass lighter
Caramelisation	The process of browning sugars in the presence of hi
Conduction	The process of exchanging heat between two objects different temperature, without the use of any means water or air (thus the objects must touch each other way of transferring heat
Convection	A process of exchanging heat between two objects th this is an indirect way of transferring heat
Dextrinisation	The process of breaking down long starch chains into
Emulsification	The process of combining water and oil together to c
Enzymic browning	The process of enzymic breakdown due to plant cell enzymes
Foam formation	The process of trapping air bubbles between protein lighter and more susceptible to growth
Food safety	All conditions and actions taken to make food safe to
Gelatinisation	The process of breaking down the chemical bonds in of water and heat
Gluten formation	The process of creating a strong, elastic, net-like stru water
Infrared	Type of invisible radiation emitted by all living organi
Microwaves	Type of electromagnetic waves with the frequencies ... Hz, used, for example, in microwave ovens
Oxidation	The process of substances (such as vitamins) decomp
Plasticity	Ability of solid fats to soften over a range of tempera spread with light pressure
Protein coagulation	The process of changing proteins from liquid to gel
Protein denaturation	The process of damaging proteins' chemical structure
Radiation	A process in which a wave of heat is being sent witho other; this is an indirect way of transferring heat
Shortening	The process in which fat particles surround flour part formation impossible

Knowing how various cooking ingredients react to different preparation and coo
a healthy, tasty and appetising dish. The cooking time and temperature are just a
correct cooking method.

The reasons why food is cooked

Food is cooked not just to taste nice, but to make it safe, change the textures, to
provide variety in our diets. Let's discover in a bit more depth some of these rea

To make food safe to eat

One of the greatest advantages of cooking is that it makes our food safe to eat b
harmful substances.

S... is a species of bacteria known to cause gastric p
...fection include stomach ache, nausea, vomiting, diarrhoe
commonly in eggs, poultry and meat, milk, and products th
creams. For this reason it is not advisable to eat these pro
Also it is better not to freeze food again once it has been d
because it allows bacteria to grow.

Revision tip

Co... ...sure **food safety**.

Other bacteria found in food include *Escheri*
(which usually live in our bowels but are pois
when in food), *Shigella* (which causes dysen
Yersinia enterocolitica (which causes sympto
to *Salmonella*).

One of the most dangerous bacteria found in food is *Clostridium botulinum*, whic
a toxin that paralyses the nerves and may lead to death (if it paralyses the interc
muscles responsible for breathing). Thankfully, there is a visible sign of its prese
the lid of a tuna or meat preserve can is bulging, you definitely should not eat its

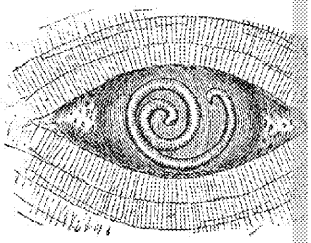
Most bacteria are killed at temperatures over 65 °C. Cooking food at temperatu
appropriate time ensures that all the bacteria and spores are neutralised.

Other poisonous agents in food include toxins, pesticides, enzymes, mycotoxins a

- Solanine is a green-coloured toxin present in badly stored potatoes (it is pro
when they are exposed to sunlight), green tomatoes and other foods. Eatin
them raw may cause stomach ache, diarrhoea or fever, so it is best to cook t
thoroughly to avoid such troubles.
- Aflatoxin is a harmful substance produced by mo...s. It is often found in pe
grains and other products which ...e ...d in improper conditions. They a
very toxic and can lead to ...r
inflammation, g... ...ations and
cancer

Did you know?

Wild boars are carriers of the *Trichinella spiralis* parasite and, therefore, their meat cannot be eaten raw!

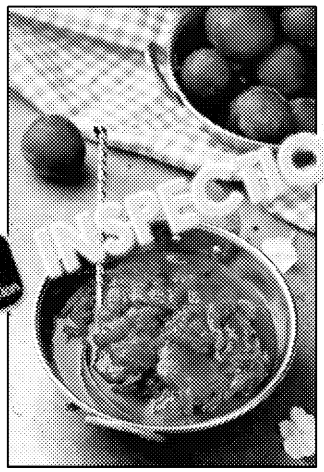


Trichinella spiralis ***is a parasite livin... cells which causes trichinosis if eate... infection include very high fever, shiv... pains. To prevent that, all meat is c... before it can find its way to shop...***

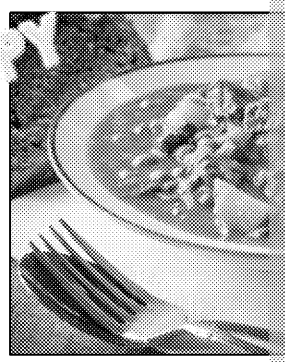
To develop flavours and smells

Cooking allows development of flavours in a number of ways:

- it evaporates water and, therefore, makes the flavour of its residue more p
- it causes sugars to caramelise, which is especially advantageous in such pr and even certain vegetables, such as onion or carrot
- during cooking, aromatic molecules evaporate and make the smell more i compounds present in foods are called essential oils (present in large amo mint)
- it allows combination of different ingredients, which leads to developing n



This plum chutney uses both caramelisation and water evaporation to obtain its strong flavour



Traditional Irish stew is which allows the characteristic textur

Cooking allows us to create the pronounced flavour of stews, jams, sauces or chu breaking down the structure of cells and freeing the aromatic chemical compoun ingredients is also helpful in developing the desired flavour and smells, e.g. by ad

To improve texture and aid digestion

You have probably noticed that cooked meat is easier not only to cut, but also to bite and chew. This is because cooking softens and loosens muscle fibres, which makes the meat softer. Also, during cooking, fat melts and penetrates the meat, making it juicy. This is not only important for your taste buds, but also makes it much easier to eat for those who cannot bite or chew, or experience various digestive issues: babies, elderly, and people suffering from Crohn's disease or irritable bowel syndrome (IBS), etc.

Cooking (especially frying, grilling and baking) also makes ain foods crunchy/crispy – which is more desirable by some s ludes meats, bread and pastries, and chips and crisps.

During cooking, some fo 's ng their physical state – from liquid to solid (or the othe ar). You can obtain the desired texture by simply adjusting c ime, e.g. four minutes for a soft-boiled egg and 10 minutes for a hard-boiled one, or 10 minutes for a thin sauce and 30 minutes for a thicker one.

Things to think about (1.1)

Identify some foods which are difficult to digest and discuss how mc could aid digestion.

To improve shelf life

Applying high temperatures is a great way of preserving food. This is because m harmful microorganism species die at temperatures above 65 °C. For this reason, cooking kills most of the bacteria or mould normally present in food and prevents **spoilage**. In this way, if correctly stored, food can last longer and maintain all of i nutritional values.

Things to think about (1.2)

for discussion and the

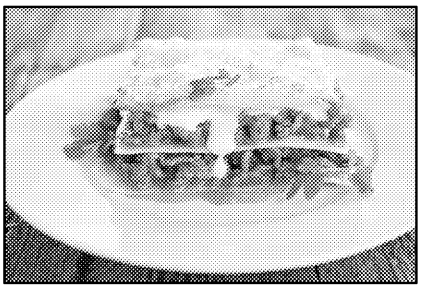
1. Discuss the 'use by' and/or 'best before' dates of various food items that are stored differently; for example, fresh fish, froze and tinned fish. Note down wheth[illegible] od items are cook not and how this impacts on the longevity of the food.
2. Discuss why s[illegible] foods and raw foods have a 'use by date or a 'best before' date.

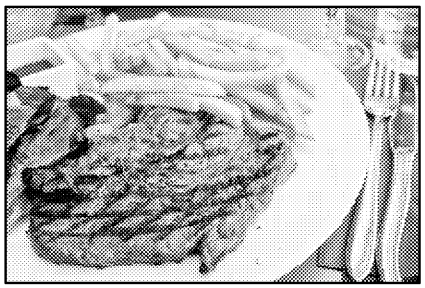
To give food variety

Cooking also allows us to have variety in our diets. This is because of two reason

- Different cooking techniques allow us to prepare the same product in a nu baked or fried.
- Different combinations of foods, seasoning, herbs and spices make it poss number of different dishes using the same main ingredient.

For example, beef can be used to prepare carpaccio, steaks, burgers, stews, soup as bolognese sauce), and so on.

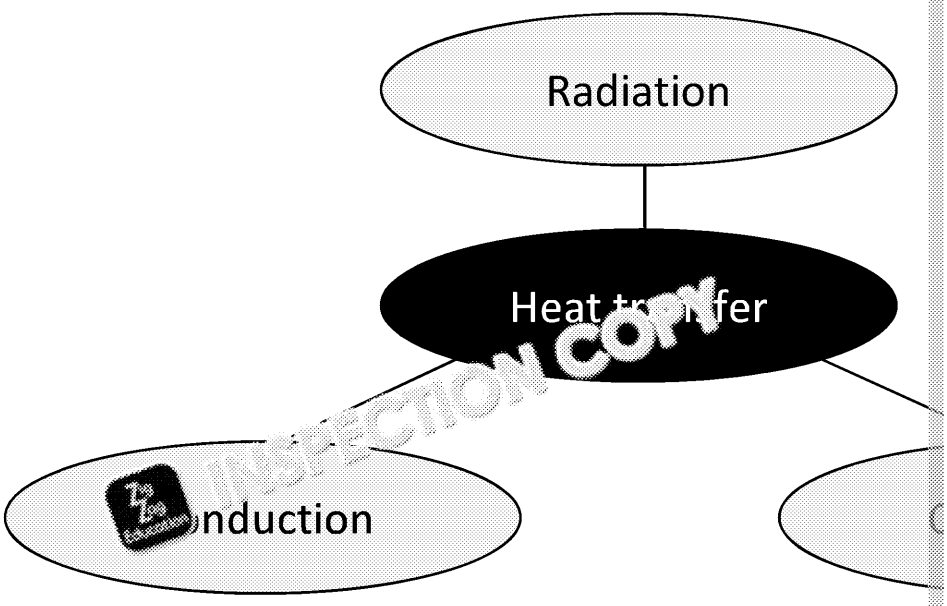




Lasagne, steaks and burgers are examples of foods made with beef, but each has a unique in which they are prepared and cooked, and through the combinations of other in

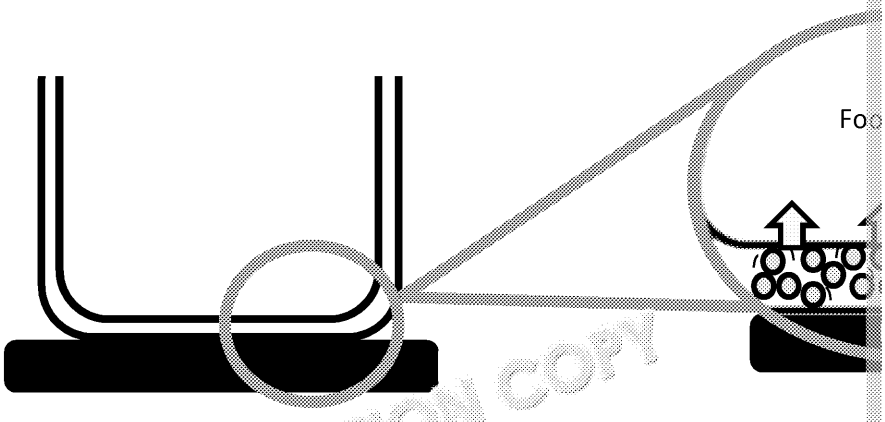
Different methods of heat transfer

There are three ways in which heat is transferred to food. These are conduction

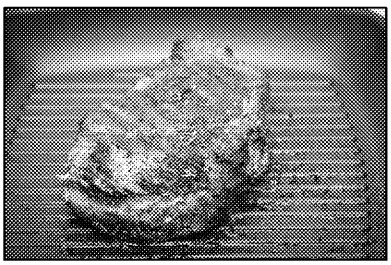


Conduction

The hotter the substance is, the faster its molecules move. That rule is applied in conduction cooking. Heat from the hob is transferred directly to the pan or pot you're cooking in. The molecules of the metal vibrate and give their energy to surrounding molecules – in this case, molecules of food in the pan. The heat (energy) is transmitted directly, which means that the two objects (the pan and the food) have to touch each other.



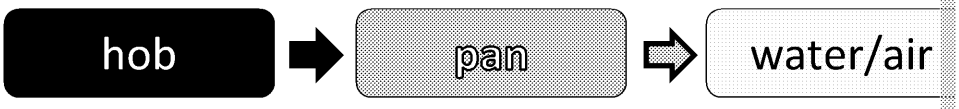
Heat causes metal particles in the pan to vibrate and causes food molecules to gain kinetic energy and heats the food

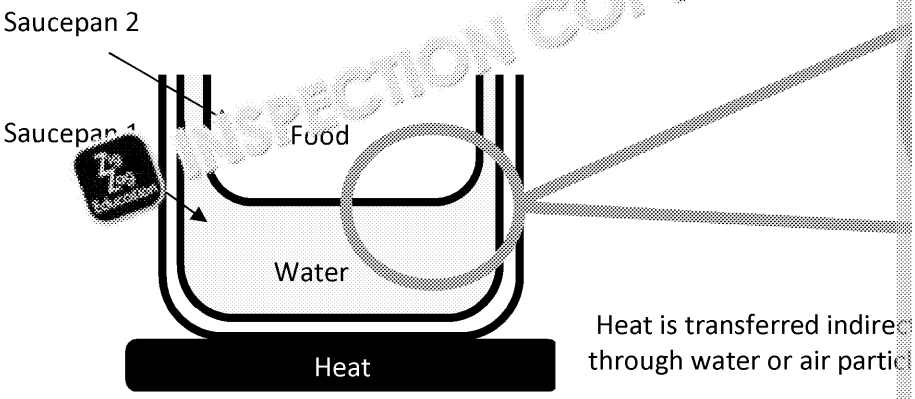


Simmering a stew, frying a steak or cooking a curry in a pan use conduction

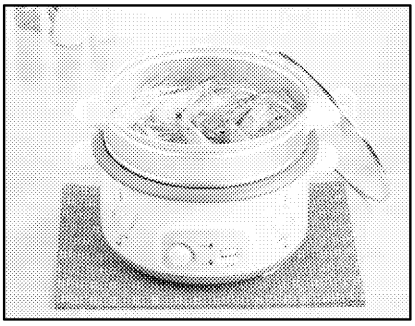
Convection

Convection is a way of transferring heat through migration of water or air particl
heated, water or air particles move up, and when chilled, they move down. Thes
convection currents, are used in cookers, during baking, boiling, poaching and st
transferred indirectly through the use of water or air.





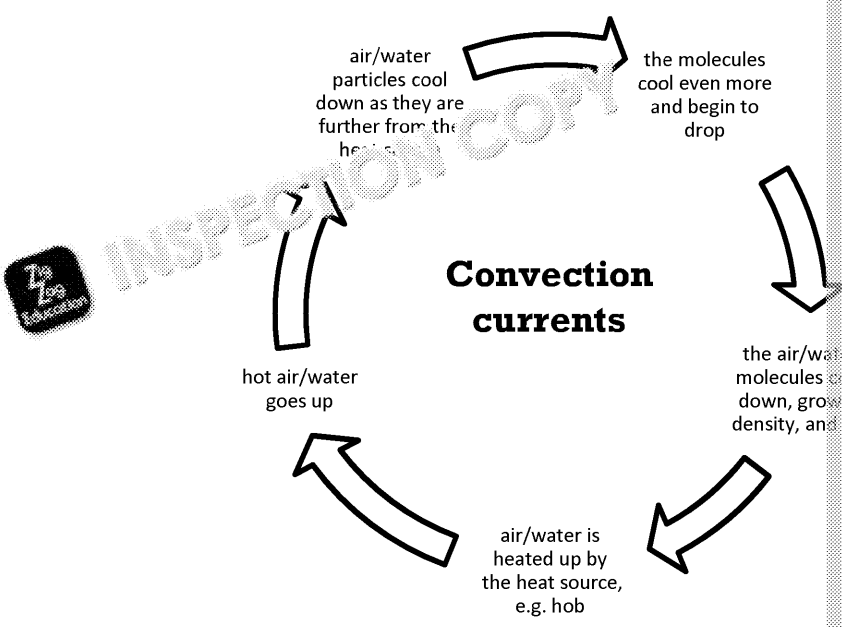
Heat is transferred indire
through water or air parti



Steaming is an example of convective heat transfer, through the use of vapour

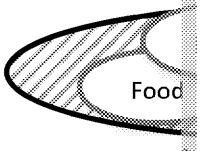
Skills

1) Prepare a blended whi
béchamel).
2) Explain how conductio
during the process.
3) Explain why it is neces
mixture.



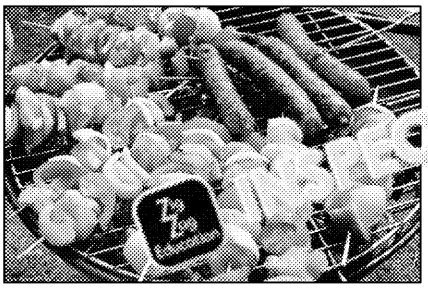
Radiation

Radiation is a technique that involves waves of heat being sent to the food – it m
the heater and the food do not need to touch each other.
Radiation involves two kinds of wave – infrared waves and microwaves.



Infrared is a kind of electromagnetic radiation, which involves the use of light waves which are invisible to the eye. In cooking, infrared radiation is used in stoves, ovens and grills, where heat goes from the source to the food.

He



Grilling/barbecuing is a classic way of using infrared for cooking as the matt black coal is effective in emitting infrared rays

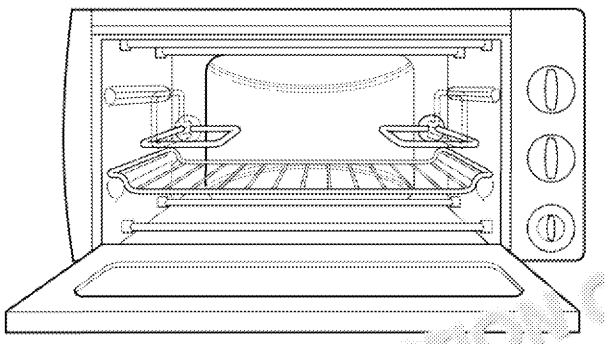
Infrared radiation is also used in toasters

Apply

Lis
may u
and nu
radiati

Microwaves are also a kind of electromagnetic radiation, but they are longer tha
infrared waves. They are, most obviously, used in microwave ovens. The waves are sent to the food and heat up particles of water, which (as you already know) move faster and faster, transferring the heat to all other surrounding particles.
As a result, the food can be warmed up quite effectively, but the use of microwa
limited only to foods which contain a high proportion of water.

It is also important to remember that microwaves can bounce back from shiny su
for example, aluminium foil or plates with shiny, metallic decoration into a micro



How a mi

1. Transformer chang
high power electri
2. Magnetron create
3. Microwaves are se
an antenna.
4. Microwaves heat u
5. Water molecules v

Skills

1) Prepare a vegetable stew using the recipe at **http://www.goodtokn**
vegetable-stew
2) Discuss what methods of heat transfer are used at each stage of prepa

Why heat transfer methods are combined?

Conduction, convection and radiation can often be combined when preparing a d
methods allows us to obtain the desired texture, flavour and appearance of the f
various methods of heat transfer when the dish we're preparing consists of vario
filling, as each of them often needs to be cooked differently. The table below sh

Cooking method	How it works
Baking, roasting	The heat from the heating element in the oven is transferred to the baking tin, which then transfers it to the food inside. The food warms up through to conduction and through convection as the hot air inside the oven circulates.
Boiling, simmering, stewing	The heat from the hob is transferred from the pan to the water, and as the water creates convection currents, it passes the heat through to the food.
Deep-frying, shallow-frying	The heat is transferred from the pan to the oil, which creates convection currents just like water. That's why frying in oil uses both conduction and convection.
Grilling, barbecuing	As the heat radiates from the heating element (e.g. coal), it heats up both the food and the grill/tin it is placed upon. As the grill/tin warms up, it begins to heat up the food through conduction – that's why grilled foods are 'striped'!

An example of how various methods of heat transfer are used when preparing a
dish is shown below.

Making spaghetti bolognese requires three steps:

1. **Cooking the pasta**
   To cook the pasta, you need to boil the water first, and then add the pasta. This process uses conduction (to transfer the heat from the saucepan to the water) and convection (to transfer the heat from the wa

2. **Cooking the sauce**
   To make the sauce, you need to fry the onion and meat first – this proces
   add tomato sauce and simmer the sauce for a long time to reduce it – du
   convection, as the sauce contains a high percentage of water.

3. **Combining the sauce with the pasta, and adding cheese**
   At the end you can decide to sprinkle your dish with grated cheese. As y
   when sprinkled on top of a hot dish – that's because it is heated by radia
   source in this case is the hot pasta and sauce mixture though, not an ov

Heat transfer summary:

Heat transfer method	Conditions	Vector
Conduction	The objects have to touch each other	None
Convection	The objects don't have to touch each other	Air or water
Radiation	The objects do not touch each other but waves of heat are being sent	Air

Apply

Take a look at a box of frozen pizza and try to work out whether it would be faster to cook it in an oven or in a microwave. Cut the pizza in half and cook each half using the different methods. Note down how long it takes and suggest why there is a difference in the cooking time.

How cooking affects food

Cooking affects food both externally (which makes it look different) and internally (which changes its features such as texture). Cooking also affects nutritional value of foods. That's because certain micronutrients – such as group B vitamins, vitamin C and vitamin A, are very sensitive to temperature and break down during cooking.

Nutritional value

High temperature, pressure, cooking time, fragmentation, contact with oxygen in the air – all these factors can affect the nutritional value of foods. Most vitamins are damaged by high temperatures; for example, 50% of vitamin B6 and 70% of folate will be damaged during cooking. It is also important to remember that some vitamins are water-soluble. This means that they will dissolve in water during boiling and will be lost if the water is drained.

Appearance

The look of food changes depending on the ingredients and cooking methods used. In meat, protein fibres will shrink and push out water (or jus), so the meat Denaturation and coagulation will cause eggs and pastry to set and become solid to either yeast or chemical leavening agents producing carbon dioxide. Rice, pas absorb water and increase in size.

Colour

The colour of the food usually changes due to the Maillard reaction, caramelisation and chlorophyll destruction, which cause the food to become golden or brown. Some vegetables, such as red cabbage or beetroot, lose their purple colour and become blue or brown if cooked for too long – the colour may then be restored by adding an acid, such as vinegar. Green vegetables, such as spinach or broccoli, may lose their colour and become dull. To avoid this, they should be cooked for a short time only, and preferably in a lidded pan.

Texture

High temperatures cause food ingredients to change their chemical structure. Co soften (meat, vegetables, fruit, rice or pasta), while others will become crispy an crust). Starch gelatinisation and water evaporation will cause sauces to thicken. proteins will cause eggs to set and change from liquid to solid. Dough and cakes due to the action of carbon dioxide, air or steam. Sugar will caramelise and crea brûlée.

Smell (aroma)

The smell of hot foods is usually more pronounced than that of cold foods. This i compounds in hot foods are evaporating and filling the air, which makes them ea especially when baking a cake or simmering a stew.

Flavour

The flavour of food may change d ges in chemical structure or due to t other flavourings. During c arch will dextrinise, giving a slightly sweet ta leading to a d er or nutty taste. A complex chemical reaction called th numerous l compounds which change the flavour of coffee or cocoa to s

Palatability

Various chemical reactions which take place during cooking affect all of the food that a food is pleasurable is called palatability. It can be described by such terms crispiness, and will usually make food appetising and desirable to the consumer.

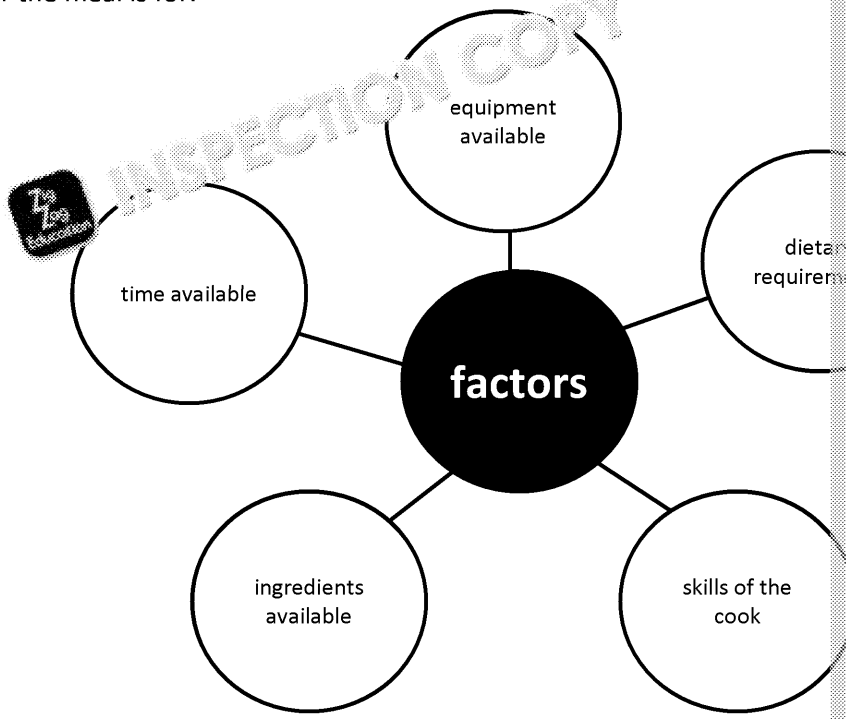
Raw onion is white and crispy

During cooking, sugar in onion caramelises, which causes the onion to change colour and taste (fried onion is sweet). Some of the sulphur-based compounds present in the onion are broken, so the smell will be sweeter and milder. The onion also becomes softer – that's because some of the fibres in its cell walls are broken down. Cooked onion will have less vitamin C than raw onion.

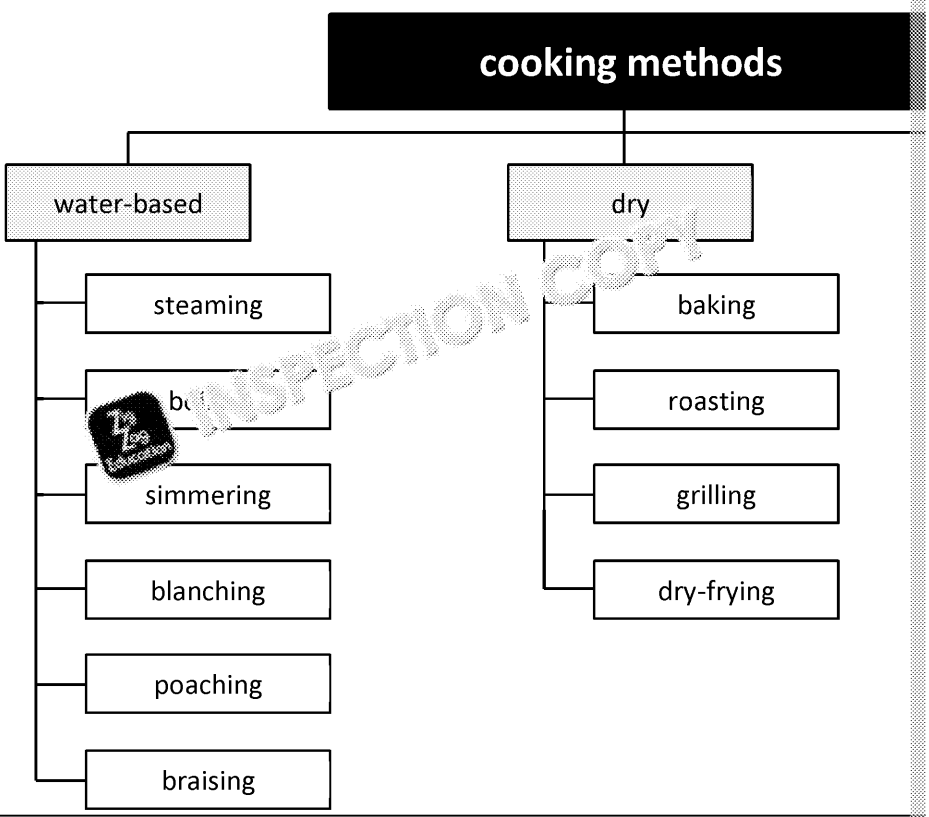
How different cooking methods affect the food

There is a wide variety of cooking methods, including water-based, fat-based and
depends on various factors, such as the skills of the cook or the requirements of
person who doesn't own an oven will not be able to make a lasagne, and a perso
not be able to poach an egg. Likewise, it won't be possible to cook a three-cours
won't be possible to cook spaghetti without water (frying isn't a good example a
is not recommended to offer triple-fried chips to someone suffering from cardio

Therefore, the choice of cooking method depends on such factors as the equipm
skill of the cook, the time available for cooking, the ingredients available and the
or whoever the meal is for.



Different cooking methods are often combined to obtain the desired meal. Cook
based, fat-based and dry methods.



Water-based cooking methods

Water-based cooking methods use water and other liquids to transfer heat – either directly (as in boiling) or indirectly (as in steaming). Their use is beneficial for a number of reasons:

- addition of fat is not usually required, making the dishes low in calories
- they help to soften proteins, which makes them more digestible
- they are safe for fat-soluble vitamins as these will not dissolve in water or
- they help to soften the starch and make it more digestible
- the cooking time may be easily adjusted – it's enough to probe the cooked whether it's done

Steaming is a technique which requires the use of a steamer or simply a strainer steamer, a small amount of water is placed in the pot or pan, and food is placed cooking, water evaporates and cooks the food above. This method is advantageo (the vitamins do not dissolve in water because they have no contact with it). Foo healthy, nutritious and low-fat.

Boiling is one of the most popular cooking methods, in which food is cooked in a heat. An example of the use of this method is boiling potatoes, cabbage or eggs and makes them easier to digest, although it also leads to loss of water-soluble v

Simmering is a technique in which food is cooked with a significant amount of liquid, but on a low heat and for a long time. An example of the use of this method is simmering a stew. Foods cooked this way will become soft and tender, but the long cooking time will decrease their nutritional value.

Poaching is a technique in which small amounts of water (or other liquid, such as wine or milk) and a low heat are applied to food to prevent it breaking apart. Poaching is used to cook delicate products such as eggs, poultry or fish, as it seals their surface and prevents them from falling apart. It is a good idea to save the liquid and use it to prepare a sauce to prevent vitamin loss.

Apply

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Braising is a cooking method which, technically, combines frying and simmering. The food is briefly fried to seal the surface, and then simmered for a long time. This way, the food remains juicy and becomes very soft and tender. The long time necessary and the high temperatures applied will, unfortunately, lower the nutritional value of the food.

Dry methods

Dry methods include those cooking techniques which do not require the use of water or fat. These are baking, roasting, grilling and dry-frying. Since these methods produce high temperatures, they may require the use of a special probe to check the doneness of the cooked food (because the surface is usually too hot to touch).

Baking and roasting are basically techniques that require the use of an oven.

Baking is applied to foods that do not have a stable structure, but will obtain it after processing. This includes such foods as muffins, sponge cake or fish pie. Be baking tray/tin with butter or fat, and sprinkle it with flour (or another powdery s from sticking. Baking helps obtain soft foods with a crispy surface – such as the c caramelise at high temperatures and add flavour to the food. Starch will break d digestible, which may be important for people with digestive tract diseases.

Roasting is applied to foods that are already solid, such as turkey or parsnips. Du
sprinkle the surface of the roast with the fat or juice that's leaking out of it to cre
softens and tenderises the food, but the long time required leads to the loss of h

Grilling is a technique which uses infrared waves to heat up the food. Grilling all
out, which makes it more appropriate for some people, e.g. those on a low-fat di
grill foods, because harmful, carcinogenic substances may be produced as a resu

Dry-frying is frying in a dry pan – without the use of fat. It usually requires the u
(Teflon, stainless steel or ceramic). During dry-frying, fat will melt and leak out o
more acceptable for people who cannot consume a lot of fat. The cooking time is
the food is cooked, the more vitamins will be lost due to th
high temperatures applied.

Apply
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All dry methods of cooking are re
reasons to people who w
weight or cut down on fats.

Fat-based ing methods

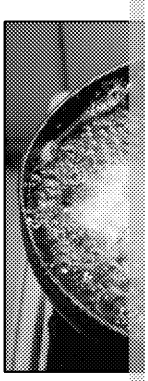
Fat-based co ng methods include shallow-frying, deep-frying and stir-frying. Frying usually produces high temperatures (around 200 °C and m
vitamins in foods. Depending on the quality and quantity of the fat used, fried fo
for different people. For example, frying in general is inappropriate for an obese person with hypertension, but shouldn't be harmful for a healthy individual.

Fat-based cooking methods use different fats, such as vegetable oils, butter, lard or goose fat, and even margarines.

Shallow-frying requires only a small amount of fat. The fat in shallow-frying:

- seals the surface and closes juices inside the food (e.g. meats)
- creates a crispy skin/surface
- gives the food the desired taste
- prevents food sticking to the pan

Shallow-frying will damage some of vitamin C and vitamin B2 due to heat, but will add more fat-soluble vitamins to the food.



These dee

Deep-frying uses large amounts of fat – this method is often used to fry chips or breaded treats such as Scotch eggs. During deep-frying, the whole product is sunk into fat, allowing it to cook evenly. Unfortunately, during deep-frying a lot of fat is a ed by the food, making it fatty and not suitable for m le. Also, the heat will lower the vitamin content i

Revision tip
Stir-frying, ng, grilling, dry-frying a poaching are ways of conserving foods' nutritional value.

Stir-frying is a variation of shallow frying, in whi
constantly in the pan. The technique is typical o
Chinese). The dish in which food is stir-fried is c
method which takes a short time only, so the fo
nutritional value and colour.

Things to think about (1.3)

Discuss the advantages and disadvantages of all of the cooking meth
dry methods). Discuss how the use of each of these methods could
and how this can influence the food choices which that individual wo

Check your understandin
Why and how food is cook

1. During cooking, rice will…
   a. increase its size and absorb water ☐
   b. decrease its size and absorb water ☐
   c. increase its size and lose water ☐
   d. decrease its size and lose water ☐

2. Sauces thicken during cooking because of…
   a. water evaporation and caramelisation ☐
   b. water absorption and caramelisation ☐
   c. water evaporation and starch gelatinisation ☐
   d. water absorption and starch gelatinisation ☐

3. Give three reasons why food is cooked.
   1 .....
   2 .....
   3 .....

4. State two methods of transferring heat to the food when baking a qui
   .....
   .....

5. List three processes that happen to macronutrients when baking a las
   1 .....
   2 .....
   3 .....

6. Explain how braising affects the nutritional value and palatability of po
   .....
   .....
   .....
   .....
   .....
   .....
   .....

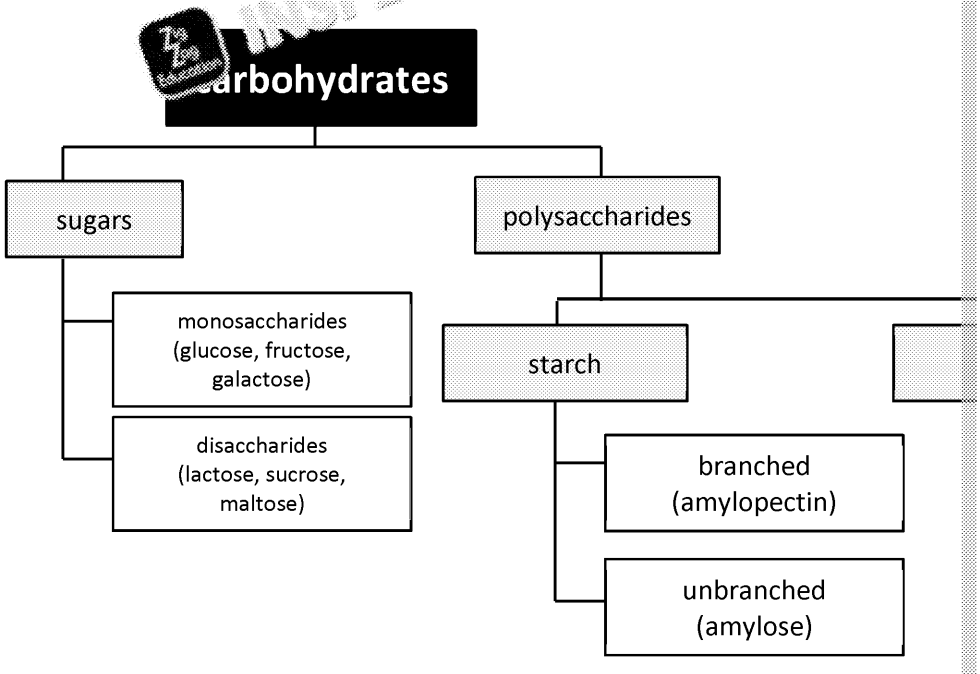
The working characteristics, and function
properties of cooking ingredi

Cooking is mostly based on the science of chemistry and physics. Knowing the ch
ingredients is very important as it helps to understand why and how an ingredien
its functions are, and how to adjust the proportions, cooking methods and time, e
assessing why a particular effect has not been obtained – and how to prevent th

Carbohydrates

Carbohydrates include sugars, starches and dietary fibre. They are present in ma
vegetables and fruit to pure sugar. Carbohydrates are the main source of energy
necessary to build DNA strands and conduct vital processes in every living cell.

Carbohydrates are all structured differently and can be split into the following gr



Sugars include monosaccharides (single molecules) and disaccharides (built of tw
They are found in table sugar, honey, syrups, etc. They dissolve easily in water.

Starches and fibre are long chains of monosaccharides bound together.

Starch is the main compound of flour. It is built from many
monosaccharides bound together into long chains which can be
either branched or unbranched (this can be important when
dissolving starch – the branched ones should dissolve more easily).
Starch doesn't dissolve in cold water, but instead forms suspensions.
The suspension is a mixture of starch particles floating in water, and
eventually, it forms a residue at the bottom of the vessel (dish, glass).
During cooking, starch can either **gelatinise** or **dextrinise**.

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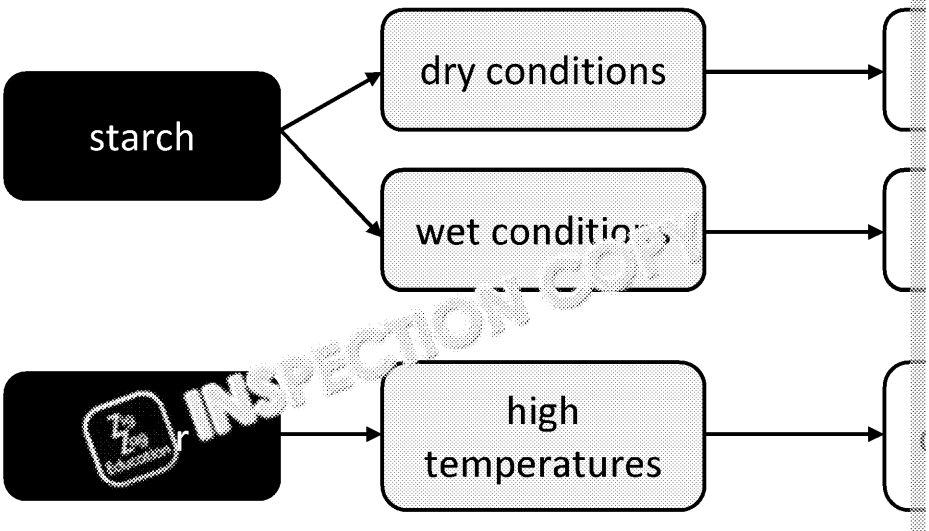
Dietary fibre is built of thousands of molecules of sugars bound together into long chains. It occurs in plant cell walls, although it is available in purified form. Fibre is usually indigestible for humans, but has many health benefits. Soluble fibre absorbs water when cooked and creates a jelly-like substance, which turns the mixture into a gel. Insoluble fibre will break down and soften during cooking, which causes plant foods to become soft.

The table below shows why we use carbohydrates in cooking. Can you think of o

	Function in cooking	Exam
Sugar (mono- and disaccharides)	Sweetening	Cakes, creams, beverages
	Bulking agent	Cakes, e.g. sponge cake
	Aeration	Creams, e.g. buttercream
	Improving flavour	Sauces, e.g. tomato sauce
	Preserving food	Jams
	Improving the text[illegible]	Cakes, e.g. sponge cake, meringue
	[illegible]mentation	In baked goods which use yeast, such
	Improving the colour	Cakes, bread and meats (thanks to c the Maillard reaction)
Flour (polysaccharides)	Bulking agent	Baked goods, such as cakes or breac
	Improving texture	Goods which are high in gluten, such
	Thickening agent	Sauces, e.g. custard, white sauce
	Improving nutritional value	Goods made with wholemeal flour, e

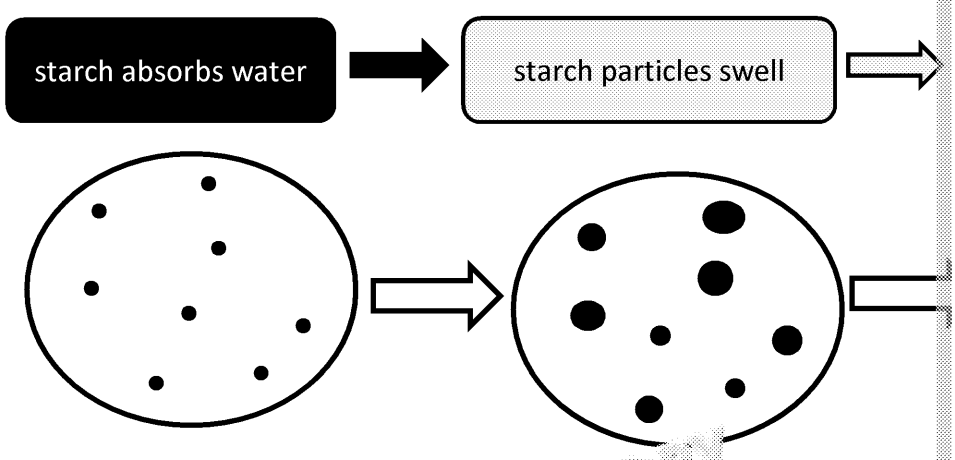
Preparing and cooking with carbohydrates

Food preparation and cooking involve many varied techniques which differently a
and the chemicals it's made of. Different cooking times and temperatures, and t
moisture will cause visibly different effects on carbohydrate-rich food products.



Gelatinisation of starch

Starch particles do not dissolve in water. Instead, they absorb it and swell, turni
process happens when the mixture of water and starch is heated and is called ge
cooking since it helps thicken sauces and other mixtures, such as puddings. The
constantly to prevent the formation of lumps. In cold water, starch granules will
will fall to the bottom of the vessel.



Starch granules in cold water

ch granules absorb water when heated.

Skills

1) Prepare three samples of béchamel sauce: use plain flour for sample 1,
and again plain flour for sample 3 but do not stir the mixture. What t

2) Explain how convection and conduction are applied during sauce-mak

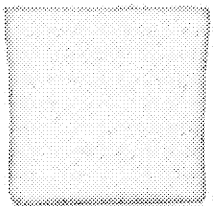
3) Explain the chemical changes that cause the sauce to thicken.

Dextrinisation of starch

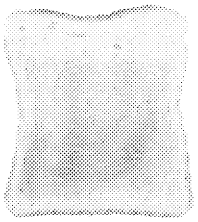
Shorter chains of polysaccharides are called dextrin. When polysaccharides, such
conditions, their long chains break down into shorter ones – this is called dextrin
while baking bread (and other starchy foods) and is responsible for the sweetish
crispiness of the crust.

Apply

Place a piece of
chew for 60 secon
changes from savo
long chains of poly
down by the enzy
sweet short chains
molecules of sugar
when bread is bei
enzymes, but heat



Fresh bread has long chains of polysaccharides.



Lightly toasted bread will have some of the polysaccharides broken down into dextrins, so its colour and flavour will change.

Apply

Toast bread on different settings in a toaster (1, 2, 3, 4 and 5) or for different lengths of time in an oven (e.g. 2, 5, 10, 15 and 20 minutes). Compare the colour of the bread slices. Note how dextrinisation changes both the appearance and the taste of the bread.

Caramelisation of sugars

Sugars include molecules of monosaccharides and disaccharides. At high temperatures, sugar crystals break and melt into syrup and change colour from light yellow through golden to brown. This is because oxygen and hydrogen are being evaporated and only black molecules of carbon are being left. Depending on the temperature and cooking time, all foods containing sugars will caramelise.

Caramelisation is used in cooking to either change the flavour or affect the colour of the food to make it more appealing. This process is used when making fudge or burning the surface of crème brûlée to create the golden, crunchy top. Caramel is also used in manufacturing cola-like beverages and is responsible for their dark brown colour.

Caram
swe

Skills

1) Group ... prepare roasted carrots and onions.
   - Group A: roast for 30 minutes at 200 °C
   - Group B: roast for 30 minutes at 160 °C
   - Group C: roast for 60 minutes at 160 °C
   - Group D: roast for 60 minutes at 100 °C

2) Make notes on how cooking time and temperature affect the colour a

Did you know?

The Maillard reaction takes place when proteins and carbohydrates are cooked by dry methods. Amino acids from proteins and sugar from carbohydrates react with each other, which results in creation of so-called Amadori compounds. These agents change the smell, flavour and colour of the food (it becomes brown). The Maillard reaction is used to obtain the desired smell and flavour of bread and pastry, beer and coffee beans.

Check your understanding: Carb

1. Dextrinisation takes place when…
   a. simmering a tomato sauce ☐ b. toasting bread
   c. cooling jelly ☐ d. boiling pasta

2. The process of absorbing water and thickening mixtures with the use
   a. dextrinisation ☐ b. caramelisation
   c. gelatinisation ☐ d. gelation

3. Caramelisation takes place at temperatures a
   a. 60 °C ☐ b. 100 °C
   c. 120 °C ☐ d. 160 °C

4. Give three fu sugar in cooking.

   1 .....

   2 .....

   3 .....

5. Explain how starch affects viscosity (stickiness) of sauces and soups.

   .....

   .....

   .....

   .....

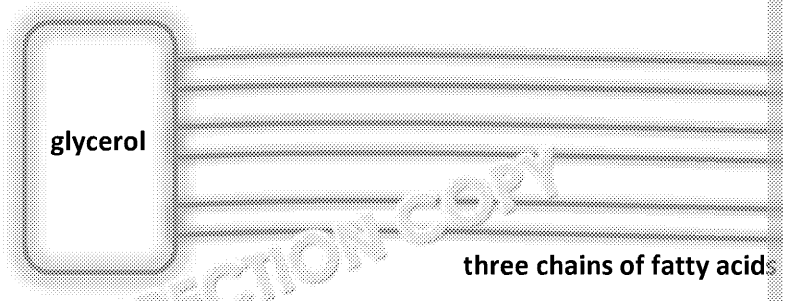
   .....

   .....

   .....

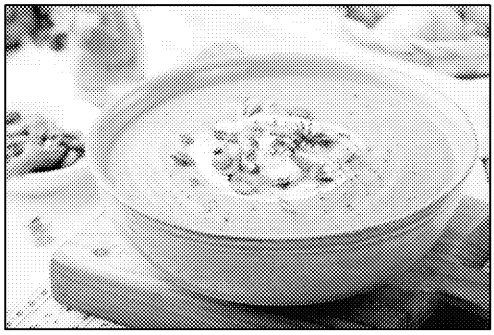
Fats and oils

Fats and oils are built of a glycerol 'head' to which three chains of fatty acids are atta
fatty acids are bound together by either single or double bonds. This determines wh
room temperature – generally, saturated fats (which have only single bonds) are sol
unsaturated fats (in which double bonds are present) are liquid and are, therefore, c
of a fat or oil is important because it determines its consistency, melting temperatur

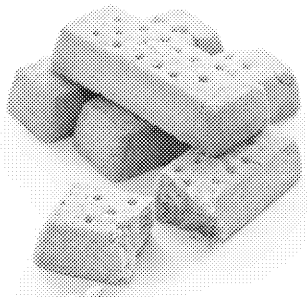


The table b ows why we need fats and oils in cooking.

	Function in cooking	
Fats and oils	Improve the texture	Butter in butter
	Used for shortening	Biscuits, pie cru
	Extend the shelf life	Baked goods, e.
	Improve the flavour	Cream in soup,
	Help to obtain a crispy surface	In fried foods, e
	Add flaky texture	Flaky pastry
	Emulsify mixtures	Sauces, e.g. may
	Add colour	Butter in shortb
	Improve nutritional value	Olive oil in salad
	Carry and improve absorption of fat-soluble vitamins	Dressing in salad



Fat from cream helps to improve the taste of cream soups and makes for a good garnish



at ps to obtain the crumbly exture of the shortbread biscuits

Working characteristics of fats and oils

The structure of fats has an important role when choosing cooking ingredients. S preparing shortcrust, while oils will be better for frying or preparing a dressing. C help to obtain the desired effect.

Plasticity

The plasticity of fats is what causes their ability to be reshaped and to melt at different temperatures (they have different melting points). A good example is butter and lard. They are solid while in the fridge, become soft and greasy at roo temperature and melt to an oil during cooking.

There are certain types of margarine which are sprea at ow temperatures – you can say that they have good plasticity.

Shortening

When mixed with st h as flour), fats create a layer around starch particle therefore, g ten from forming long chains. This is called **shortening** and obtain crun umbly pastries, as in biscuits. It is noticeable that only solid fa shorten the mixture – oils will rather turn it into a lump. For this reason, it is bett cold butter/lard and cold water, and then let the pastry rest in a fridge to obtain melt-in-the-mouth pastry.

Skills

Prepare two shortbread doughs, one using butter and the other using half bu biscuits and describe the difference in texture and taste.

Aeration

Similar to foam formation in proteins, aeration is the trapping of air bubbles in th mixture. This leads to the creation of creams, which can be observed when whis butter with sugar or when whipping cream. Aeration is also used to obtain the c like texture of ice creams.

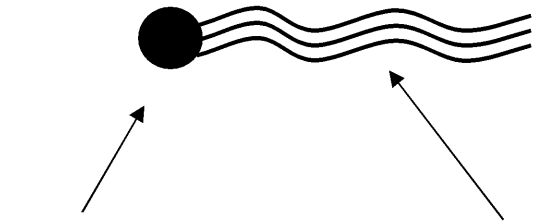
Apply

1) Pour three different kinds of cream into a bowl: single cream, whipping c
2) In groups, whisk each cream, measure the time needed and observe the
3) Compare how much fat each of the creams contains and how this affect to change in volume.

Emulsification

Emulsion is a mixture of oil and water. Depending on the g edients used, we ca distinguish water-in-oil emulsions and oil-in-wate en ions. An example of an emulsion is milk: usually, fat molecules a e ad evenly in the liquid, but when will form a layer on the top. An e am, l or a water-in-oil emulsion is butter (noti 'sweats' when taken ou e fridge).

Since fat is i nobic, the particles of fat and water will repel each other, lead separation of the emulsion into layers. To prevent this and make the mixture mo emulsifiers are used. One of the most popular emulsifiers is lecithin, present in e Emulsions are used not only in cooking, but also in the cosmetics industry.



When put in water, fat p[illegible] will turn their hydrophilic heads towards it, crea[illegible]

Emulsifiers [illegible]ach to oil droplets, keeping them dispersed and making the mi[illegible]

Did you know?

Mayonnaise is also an emulsion, made of vegetable oil, egg yolk, vinegar and fl[illegible]

- liquid phase – vinegar (sometimes milk is also used)
- oil phase – vegetable oil, such as sunflower oil; various types of mayonna[illegible] other kinds of oil, such as olive oil, to improve their nutritional value
- emulsifier – egg yolk; it is a natural source of lecithin, which suspends oil [illegible] the mixture and prevents layering.

Large factories may also use homogenisers – special machines which pump th[illegible] and make oil droplets smaller, making them easier to suspend in the mixture.

Research

Read the label of a mayonnaise jar/bottle and try to define whether it's an oi[illegible] a water-in-oil emulsion. Justify your answer.

Research

Check what substances are used as emulsifier[illegible] at **zzed.uk/ 8228-fo[illegible]**

Check your understanding: Fats

1. Shortening means that…
   a. fatty acids cannot form ☐ b. gluten fibres cannot f
   c. sugar chains become shorter ☐ d. carbohydrate chains

2. Plasticity means that…
   a. fat is solid at room temperature ☐
   b. fat is liquid at room temperature ☐
   c. fat is easily spreadable at room temperature ☐
   d. different fats melt at the same temperatu ☐

3. Which statement about fats is [illegible]?
   a. Fats dissolve vita[illegible] ☐
   b. Fats with [illegible]te emulsions. ☐
   [illegible]ts [illegible]ld create emulsions. ☐
   fats have the same melting temperature. ☐

4. State two methods or processes used during the production of spong

   1 .....

   2 .....

5. Describe how the chemical structure of fats affects their physical stat

   .....

   .....

6. Explain the need to use emulsifiers in mayonnaise.

   .....

   .....

7. Explain how shortening helps obtain a crisp pastry.

   .....

   .....

   .....

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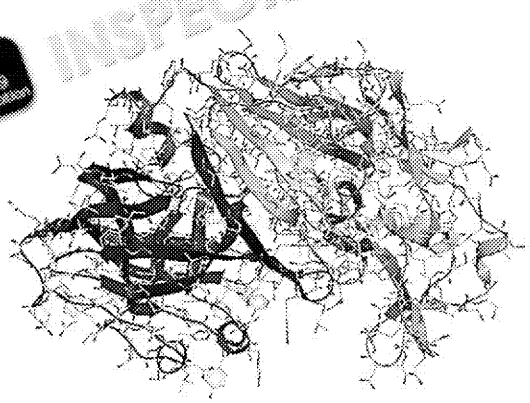
Proteins

There is a wide variety of food products that are rich in protein. Although their m
protein in the diet, they also play a crucial role in creating the desired texture, fla
dish. One of the most versatile protein-rich ingredients is egg. Due to its chemic
various dishes, and for different reasons. Other protein-rich staples include milk
functions of each of these products in cooking are described in the table below.

	Function	
Egg	Binding agent / improving the texture	Cakes, muffins
	Glazing (adds shine and lengthens shelf life)	Bread rolls
	Coating (helps breadcrumbs to stick to f	Breaded fish, p
	Leavening agent	Cakes, soufflés
	Thickening agent	Sauces, e.g. cu
	Stabiliser/em ifier	Sauces, e.g. m
	Im es the moisture	Cakes, muffins
	mp oves nutritional value (by adding protein, itamins and minerals, omega-3 fatty acids)	Sweet and sav
	Improves the appearance (used as a garnish)	Garnish in sala
Milk	Binding agent	Muffins, panca
	Improves the texture	Yorkshire pud
Cheese	Improves the flavour	Sauces, e.g. ca
	Adds colour	Sauces, fillings
	Adds texture	On pizza or in
Yoghurt and buttermilk	Improves the texture (used as a marinade)	Meats, fish
	Improves the nutritional value (lowers fat content)	Salads, soups,
	Thickening agent (adds creamy texture)	In soups and s
Cream	Thickening agent	In soups and s
	Improves the appearance (often used instead of garnish)	In salads, soup
	Improves the texture	In creams and

Proteins are large biomolecules built of hundreds of amino acids. Amino acids b
of peptides, and peptides bond together to form longer chains of polypeptides (p

amino acids → peptides → polyp



*In the quaternary str
chains of proteins join t
functioning unit, suc*

Proteins can adopt different structures, usually to save room and fit more of them into a cell. Amino acids may react with each other, creating new chemical bonds.

1. **Primary structure** – when the protein has the form of a simple chain of amino acids bonded together.

2. **Secondary structure** – when the chain starts to form a spiral (helix) or harmonica (sheet); here, the amino acids come closer together, creating hydrogen bonds between them, which gives them one of these shapes (shown on the right).

3. **Tertiary structure** – when the spiral/harmonica curls more tightly to form a ball or other 3D shape (usually to save room). In the tertiary structure the protein is still made of one chain of amino acids, which now forms three different types of chemical bond (peptide bonds, hydrogen bonds and disulphide bridges).

4. **Quaternary structure** – when different chains of proteins form a 'lump' made of different tertiary-structured proteins, to form a fully functioning biological unit such as an enzyme or hormone.

Now you have a better understanding of how proteins are structured, we can begin to look at how different methods of preparation and cooking can change the structure and chemical properties of a protein.

The use of proteins in cooking

Protein denaturation

Denaturation is a process in which chemical bonds in the proteins are broken, lea
structure. This happens in certain conditions:

1. when heat is applied to a protein, e.g. when baking a soufflé or boiling an e
2. when acid is applied to a protein, e.g. when lemon juice is added to mering
3. due to mechanical actions, such as whisking egg white (see foam formatio

Different proteins denature at different temperatures. For most of the proteins i
denaturation is around 65 °C or more. This is why eggs set, meat and fish becom
spongy when cooked.

Acid is also capable of damaging bonds in proteins. This is used when adding lem
foam from collapsing (e.g. whipped egg white for meringue) or when marinating

Foam formation

Mechanical actions, such as whisking, also lead to the damage of protein structu
be partially reversed – you can notice how whipped egg white will turn into liqui
During whisking, protein molecules stretch and tiny air bubbles are forced into the liquid and trapped in it, forming a foam. Foams are used to lighten the texture of food, to make it more palatable and to allow it to rise during cooking. Foam formation is used to prepare sponge cakes, soufflés, ice creams, marshmallows and many other foods.

Notice that if beaten for too long, the proteins will shrink and push out water – this is called syneresis.

Apply

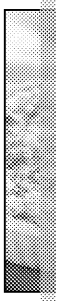
1) Prepare a
obtain a w
2) Divide th
3) Add a te
second b
in the thi
4) Write do

Skills

1) Marinate a piece of pork and a piece of fish. Compare the structure of
marinated pieces.
2) Roast all of the products. Compare the structure. What do you notice
3) Learn at **zzed.uk/8228-easy-marinades** how to make various mari

Coagulation

Coagulation is a process in which large particles of protein agregate and form lumps. This is because they are being deprived of t lectric charge. You can observe it by adding salt to egg s this process is usually reversible. Coagulation is used f pple, in salted fish – to reverse it, you need to soak the f in water in order to wash out the salt. Coagulation often take s taneously with denaturation, so it might be di to entiate them; for example, when frying eggs, the proteins bo ture and coagulate, leading to the final change in texture. Coagulation may also be caused by enzymes, such as rennin used in cheese production, and heat; for example, when boiling eggs.



In q
in r

Apply

1) Prepare five eggs and boil them for different lengths of time: 3, 5, 7, 10
mark the shells with a pen to know when to remove each egg from the
2) Peel the eggs and cut them in half and note down the differences you c

Gluten gives the dough elasticity and traps air bubbles, allowing it to rise

Gluten formation

Gluten is the protein found in certain grains (such as wheat, rye and barley). Gluten is formed from two kinds of protein: glutenin and gliadin. When mixed with water, they join together and form a net-like structure. Gluten fibres are elastic and can be easily stretched, which gives the dough a sponge-like structure. This feature is called **elasticity**. This is why wheat b is soft and elastic, and gl tei fr bread is rathe and brittle.

During bread making v t r ces carbon dioxide (CO_2). The gluten net i l e se it traps the carbon dioxide bubbles and allows t gh to rise.

Did y

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safely eat
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problem
related to

Skills

1) In groups, prepare three kinds of pasta dough using different flours, su
flour, plain flour and cornstarch. You can use the recipe at **zzed.uk/ 8**
2) Write down your observations.

Check your understanding: Pr

1. Which process occurs when kneading a bread dough?
   a. foam formation ☐ b. denaturation
   c. coagulation ☐ d. gluten formation

2. Denaturation CANNOT be caused by…
   a. adding lemon juice ☐ b. adding kitchen salt
   c. adding balsamic vinegar ☐ d. adding spirit vinegar

3. A marinade tenderises meat because…
   a. it contains salt ☐ b. it contains oil
   c. it contains acid ☐ d. it contains pepper

4. Coagulation t[illegible] when…
   a. [illegible]ki[illegible] bread ☐ b. baking a quiche
   c. [illegible]sting bread ☐ d. cooking pasta

5. State three functions of eggs in cooking. (*3 marks*)

   Function 1 .....

   Function 2 .....

   Function 3 .....

6. Explain how the use of high-gluten flour helps produce a quality doug

   .....

   .....

   .....

7. Explain how protein coagulation and denaturation allow one to produ

   .....

   .....

   .....

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   .....

Fruit and vegetables

Various cooking and preparation methods affect the nutritional value of fruit and
important source of fibre, vitamins and minerals. Special care should be taken to
damaging influence of external factors, such as oxygen or light. To prevent the lo
fruit and vegetables – and maintain their appearance, texture and taste as much a
taken when preparing and cooking, such as:

- not exposing them to air or light unnecessarily to prevent such processes a
  oxidation
- consuming the liquid in which they were cooked
- microwaving, steaming, roasting or grilling vegetables rather than boiling t
- shortening the cooking time whenever possible
- scrubbing instead of peeling

Enzymic browning

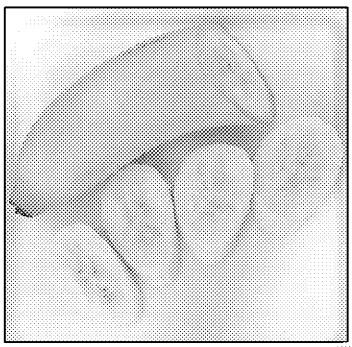
When peeling or cutting [illegible] you destroy the structure of plant cell walls,
spill out. The [illegible] cells' juices, called polyphenol oxidase, reacts with o
substances [illegible] tissues, causing them to brown. This is damaging to the plant
other hand, [illegible] obtain the desired flavour of tea, coffee or chocolate. The pro
number of fruit and vegetables, such as:

- avocados, bananas, peaches, pears, apples, mangoes, apricots, plums, gra
- aubergines, mushrooms, potatoes, lettuce

Enzymic browning can be slowed down or stopped by either:

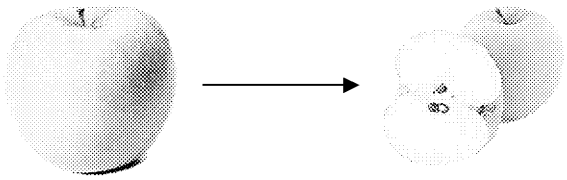
- lowering the temperature, e.g. putting the cut vegetables into the fridge
- inactivating enzymes by blanching
- adding acid, such as lemon juice or vinegar to foods
- removing oxygen – this is applied in salad factories, where salads are pack

Enzymic browning will accelerate in the presence of iron or copper – for this reas
plastic containers to store the food.



Freshly cut banan

*The same banan
minutes will start*

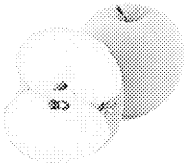


The polyphenol oxidase enzyme is activated by oxyge molecules from the air.

When the fruit is cut, the cells are damaged, which causes the enzymes inside it to have contact with oxygen.

Plant cells are full of different substances, including enzymes. The enzyme called polyphenol oxidase is usually inactive and waits for the cell to send it a signal to start working.

La[illegible]e / blanching



Acid or heat enzyme so the co

Research

Explore in more detail why enzymic browning takes place at **zzed.uk/ 822**

Oxidation

Oxygen is necessary to live – it is produced by plants from carbon dioxide and used by animals for breathing. However, oxygen has a destructive effect on most foods, causing substances in them to oxidise. During oxidation, food particles lose electrons, which are caught (or, more often, stolen) by oxygen molecules. This leads to food spoilage and loss of nutritional value, and to development of an unpleasant flavour and smell.

Natural antioxidants are present in foods (such as vitamins A, C and E), but it is best not to expose the food to air if possible. Oxidation may be stopped or slowed down by:

- protecting food from oxygen, e.g. by covering it or packing it in oxygen-free conditions
- use of antioxidants, either natural of artificial, such as lemon juice, lime juice, or vinegar
- use of barrier substances such as salad dressing which covers the surface

Apply

- Take three apples of differe[illegible] e.g. Golden Delicious, Gala and Jo
- Cut or grate them a[illegible]eav[illegible] for 30 minutes.
- After that [illegible] should observe different stages of oxidation – this [illegible]t [illegible]ounts of vitamins protecting them from the process.
- R[illegible] the experiment, but add lemon juice to each sample. What do

Research

Explore the variety of English apples and pears at **zzed.uk/8228-apple-varia** antioxidants in them and assess which apple varieties are less prone to enzymi

Check your understanding: Fruit an

1. Oxidation is undesirable because…
   a. it increases the amount of vitamins to dangerous levels ☐
   b. it leads to vitamin loss ☐
   c. it prevents food spoilage ☐

2. Antioxidants include…
   a. vitamins A, C and K ☐
   b. vitamins A, C and E
   c. vitamins C, E and K ☐
   d. vitamins A, E and K

3. Enzymic browning affects mostly…
   a. dairy products
   b. nuts
   c. meat
   d. fruit and vegetables

4. C…tic… …to…
   …development of a bad smell and flavour ☐
   …loss of nutritional value ☐
   c. an unappetising appearance of the food ☐
   d. all of the above ☐

5. Enzymic browning will happen more quickly in…
   a. fruit which are high in vitamin C ☐
   b. grated potatoes kept in a metal bowl at room temperature ☐
   c. vegetables which are cooked whole ☐
   d. fruit kept in a covered bowl in a fridge ☐

6. Explain the difference between enzymic browning and oxidation in fru…

   .....

   .....

   .....

7. List three methods of preventing enzymic browning, and explain why …

   Method:.....

   Why it works: .....

   .....

   Method:.....

   Why it work… .....

   .....

   Method:.....

   Why it works: .....

   .....

Raising agents

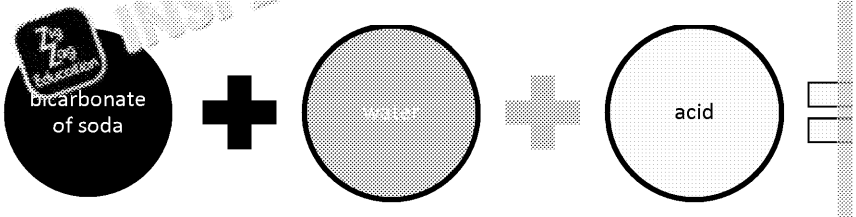
Raising agents are used in cooking to lighten the texture of certain foods and ma
consumers. They introduce gas to a mixture, which is then trapped in it, helping

Chemical raising agents

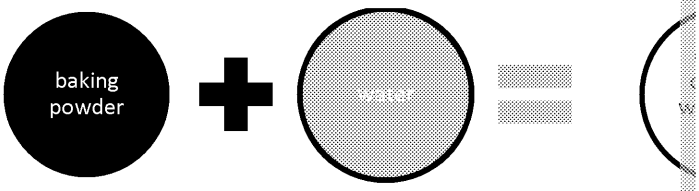
Chemical raising agents include bicarbonate of soda and baking powder.

Bicarbonate of soda ($NaHCO_3$) is a white powder added to baked goods for leave
properly and avoid a soapy aftertaste.

In the presence of water, acid and heat, it turns into carbon dioxide (CO_2) – a gas
mixture. The reaction also produces small amounts of water (vapour) and salt, w
During baking, the carbon dioxide turns into air bubbles. As these expand and ris
Bicarbonate of soda is used in heavy textured cakes and cakes which contain an acidic in
lemon juice.



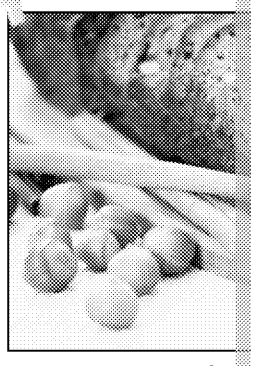
Baking powder is a white powder which contains bicarbonate of soda and a wea
phosphate or sodium sulphate. In contact with water, it will go through many ch
end will produce carbon dioxide. During baking, the gas will expand and cause th
powder is used in many recipes, such as sponge cake or pancakes.



Self-raising flours already contain raising agents (usually baking powder) in corre
good choice if you don't know how much to use.

Using too much of a chemical raising agent can cause a soap-like, bitter flavour, a
to use only as much as indicated in the recipe.

Self-raising flour already contains raising agents. Note that it's also fortified with calcium, iron, niacin and thiamine.



Bicarbonate of so gingerbread, carrot cak their s

Mechanical ways of raising (air as a raising agent)

Mechanical ways of raising include mechanical actions that help incorporate air i
There are many mechanical methods to be aware of:

Method	How and when it wo
Whisking	Whisking helps introduce a lot of air into the mixtu liquid and creating a foam. A metal or plastic whisk egg whites into a foam to produce, for example, me
Beating	Beating with a wooden spoon helps produce batter heavy for a whisk. Batters are used to prepare pan or tempura for prawns.
Sieving	Sieving flour traps air bubbl tween flour granul sponge cake.
Creaming	Creamin t a bubbles in a mixture of fat and s th ar the mixture, the lighter colour it will ha ing ice creams or whipping cream.
Folding	Folding traps air between layers of food, e.g. in Fre
Rubbing in and kneading	Kneading introduces air into the dough. It is used i dough, doughnuts and scones.

Steam as a leavening agent

Steam can be used as a leavening agent when a mixture has a high proportion of liquid and is cooked at a high temperature. When the food is exposed to heat, the water reaches its boiling point and turns into steam. During cooking, the steam rises and expands, pushing the food mixture upwards. Steam is used to produce puff pastry (giving it a layered texture), choux pastry (causing it to become hollow) and Yorkshire puddings (causing them to rise).

Skills

1) Prepare a basic soufflé. You can use a recipe from **zzed.uk/8228-cheese-souffles**
2) What raising methods will you use and why? **S6**

Biological raising agents (yeast)

In the presence of food, water and warmth, yeast br down sugars and produces carbon dioxide and alcohol ds to rapid growth of the mixture. This process is used e fo industry.

Yeasts are th production of wine, beer and kefir (fermented milk beverage), a baking.

Skills

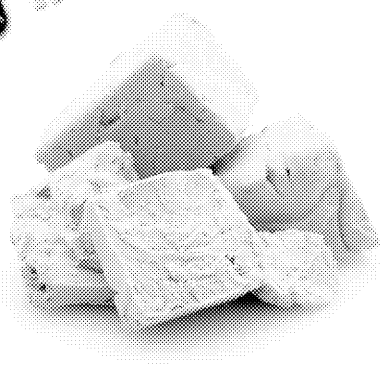
1) Prepare a batter for a savoury roulade using eggs, flour, milk, butter an
2) What raising method will you use? Why?

During the fermentation of yeast, sugar is transformed into carbon dioxide and alcohol, which dictates the final flavour of the given product. During baking, the carbon dioxide produced turns into air bubbles. As these expand, the mixture rises.

Yeasts are available in many forms:

- **Fresh** – a soft beige block, with a faint smell of mushrooms; it is necessary to grow it first in a bowl with warm water and sugar before adding to a batch of dough
- **Dried** – small granules that have to be restored before use (dissolved in water or other warm liquid)
- **Easy-blend** – powder added directly to the bat

Yeast is usually used in production of [illegible] sugar-rich and low-fat dough such as [illegible] bread rolls, pizza or doughnuts.



Fresh yeast.

Skills

1) Prepare one bread dough using bicarbonate of soda, and one using yeast. Compare the time needed to prepare and bake the doughs.
2) Compare the taste of the breads.
3) Assess the nutritional value of each bread.

S7, S8

Check your understanding: Raisi

1. Which of the following statements is TRUE about mechanical raising a
   a. They incorporate air into the food. ☐
   b. They incorporate carbon dioxide into the food. ☐
   c. They produce alcohol. ☐
   d. They produce carbon dioxide. ☐

2. Sieving is a mechanical raising agent because…
   a. it traps air between fat particles ☐
   b. it traps carbon dioxide between fat parti s ☐
   c. it traps air between starch particl s ☐
   d. it traps carbon dioxide b tarch particles ☐

3. Yeast is NOT s o produce…
   ee ☐ b. wine
   fir ☐ d. buttermilk

4. What gas is produced by the use of baking powder?
   a. carbon monoxide ☐ b. nitrogen
   c. hydrogen ☐ d. carbon dioxide

5. Give two reasons why yeast is used in production of food. For each f example of a food in which this function is used.

   Function 1 .....

   Example.....

   Function 2 .....

   Example.....

6. Give three examples of mechanical raising agents, and describe how t

	Mechanical raising agent / method	How it wor
1		
2		
3		

Bonus chapter: the most common faults in co prevent them

There are many factors in cooking which can affect the end result which is your d cooking mistakes happen is key to preventing failure in the future. The most com

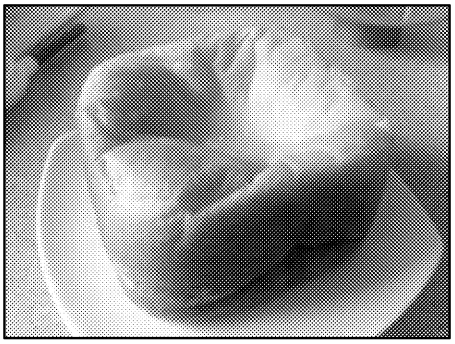
- lack of skills in the cook – but don't worry, you will learn everything you
- lack of care when measuring ingredients
- improper time and temperature of cooking
- improper preparation technique, including overdoing and underdoing a d
- improper choice of ingredients

Common cake mistakes

The most common ingredients us making include flour, eggs, sugar an fat, sometimes with the a raising agent or other ingredients. The tabl below descri the common problems encountered during cake making and explain o prevent them in the future or how to remedy the situation!

What happened	Why it happened	How to remedy it or pre
The cake is tough and dry	Too much flour (or other powder, e.g. cocoa) was used	• Measure the flour carefully next chocolate cake, substitute the a amount of cocoa • Cut the cake in half horizontally alcohol or squash – it will make dessert, such as tiramisu
The cake has sunk in the middle	The cake is under-baked	• Adjust the cooking time accordi made and the size of baking tin • Check the readiness of the cake sticking to it, the cake needs mo • If the top is already browned bu cover the surface with aluminiu
	You used too much sugar and/or baking powder, and the gluten softened too much – so it wasn't able to support the cake!	• Measure the ingredients proper • Cut the cake into pieces and use similar to bread and butter pud
	You opened the door during cooking	• We know it is tempting, but coo the oven, so the cake may sink e prop amount of time shown i to open the oven needles check on the cake by peeking th
The top of the cake has cracked	You poured tin	• It is good practice to only fill the height – exceptions include souf need to be fully filled before bal
	The temperature was too high and the surface cooked before the cake had risen properly	• Put the cake on the middle shelf temperature slightly next time • To save the cake, cut off the top use it as a crumble, or add to cu dessert

What happened	Why it happened	How to remedy it or
The cake has not risen at all	You didn't use the proper raising method, e.g. folded in beaten egg whites too quickly or didn't cream the sponge for long enough	• Next time, spend more time en aired, by beating/whisking the e flour in, etc.
	You didn't add enough raising agent	• Measure bicarbonate of soda c acidic ingredient in the dough!
	You folded the flour in too vigorously	• Next time, fold in the flour gen don't knock out the air bubbles
Cake has a hard crust	Too much sugar was used	• Nex[illegible], measure the ingred [illegible]ecipe measures them in cups! kitchen scales.
	You used gran[illegible]ed sugar inste[illegible]ter sugar	• It is always best to use a type o such as caster sugar – and in so the crystals are able to melt du
	[illegible]u didn't cream the dough properly	• The mixture of sugar and butte feel tiny crystals in it, continue
Fruit has sunk	The fruit was not dried properly	• After washing the fruit, strain i paper towel to make sure it is • You can also coat it with a sma
	The cake mixture was too wet	• If you think the mixture may be flour – experienced cooks know
The cream has curdled	You placed it too close to a heat source, e.g. hot hob or heater	• Always use cream/cheese strai as far away from the hob/oven • Try whisking in a spoonful of w and then give it another good w
	The mixture was too acidic	• Although this can be desirable you don't want your buttercrea • You can try to save the cream b little fresh cream
	You used wrong type of cream/cheese	• Low-fat cream/cheese usually s cream/cheese with a higher fat • Try whisking a teaspoonful of c



Other baked goods, such as bread and ot
also fail to rise properly for a variety of r

Did

Bread
have d
on a sl
moistu

What happened	Why it happened	How to remedy it or
Bread did not rise	Lack of sug dough	• The yeast needs sugar to multi • Mix the yeast with warm wate growth before adding to the flo
	ack of water in the dough	• The yeast needs water to multi • Ensure the correct proportions
	Too low a temperature	• Low temperature slows down t • Ensure warm water is added to • Control the temperature at wh
	Too high a temperature	• High temperature may kill the y • Ensure the dough is kept away f ovens or radiators
	Too much salt added	• Salt lowers the activity of yeast • Ensure the correct proportions • Measure the amount of salt ad
	Too little time to rise	• The yeast needs time to work • Ensure you have enough time t volume; this may take a longer depending on the temperature
Bread has a tough texture	Too little salt added	• Salt helps to strengthen the glu • Ensure the correct proportions • Measure the amount of salt ad
	The dough was kneaded too little or too much	• Kneading helps to develop the g • Ensure you knead the dough u • Ensure you do not knead the d much carbon dioxide out of it

Pastry problems

Although shortcrust pastry may seem easy, sometimes it does not turn out as expected. It is crucial to pay attention to the temperature of the ingredients, the pastry and your own hands, as they all play a role in creating a nice, crumbly pastry.

What happened	Why it happened	How to remedy it or
The shortcrust pastry is sticky and difficult to handle	You used soft fat	• Next time use cold, hard fat
	It is too hot in the kitchen	• Try t…en the window to l…
	You overdid the pa…	• Try to knead the pastry as f… warmth can melt the fat • Wrap the pastry in cling film minutes so the fat can hard…
The shortc… pastry shrank during baking, and the filling spilled out	You didn't let the pastry relax	• Next time, after rolling put t… gluten in it can relax
The shortcrust pastry looks raw and wet after cooking	The pastry is underbaked	• If you noticed this immedia… stick it back for another 10 … temperature slightly
The shortcrust pastry is too dark/burnt	You overbaked the pastry	• Next time, adjust the cooki… pastry 5–10 minutes before … each oven works differently
	The temperature was too high	• Next time, adjust the tempe… same, and sometimes the te… may be too high or too low
	The pastry was too high up in the oven	• Always try to put the pastry …
The choux pastry has collapsed after baking	You didn't bake the choux pastry for long enough	• Choux buns rise thanks to s… inside walls of the choux bu… cause them to collapse afte… • Next time, make sure the ch… lower the temperature of th… • Alternat…vely, right after rem… v… pi…ce each one with a … steam out
The Choux pastry didn't rise	You didn't c…t…e butte…	• It is important to cut up the … will help it melt faster. The … milk, the more liquid evapo… be less liquid to create stea… • Next time, cut up the butte… choux buns onto the baking … water to produce extra stea…
	You cooked the pastry for too long	• Water has evaporated from … choux pastry
The choux pastry has risen unevenly	You added the flour a little at a time	• It is important to tip all the … butter mixture at once. Oth… soak up more liquid, and so … that they will bake unevenly

Sauce slip-ups

There are many different sauce-making techniques. Some sauces are based on st
some require a long cooking time to allow the reduction of liquid and concentrat
flavour, and others require the use of emulsifiers. Sauce is often the key element
dish, and it is worth knowing how to make it well.

What happened	Why it happened	How to remedy it or preve
The roux sauce has gone lumpy	The sauce was not stirred properly	• Next time, stir the flour into the butter then slowly add the liquid a little at a ti • Continue whisk l the time until the • Strain th u nto a clean saucepan n (throw away the lumps!)
The sauce is burnt at the bottom	You are using too high a h	• Usually, it is best to use a low heat as it better – it takes longer, but the effect i
The sauce too pale	u didn't cook the roux long enough	• By increasing the cooking time, you ca from white through golden ('blonde') t the butter and flour mixture sit on the l to time until the roux has the desired c and slowly stir in the liquid, and put ba
Mayonnaise is separating	There is not enough moisture, so the oil droplets are not dispersed correctly	• Whisk in a spoonful of water
	The oil was added too quickly	• At the beginning, add the oil drop by d ensure it has been fully incorporated in • Then, make sure you add the oil in a st
	The ingredients were at different temperatures	• Next time, make sure all the ingredient • Put a fresh egg yolk into a clean bowl a mayo spoonful by spoonful until the m

Other common mistakes

Both new and experienced cooks can make mistakes – due to lack of either skill, k
haste is not your friend when in the kitchen, so it is best to always spend your tim
recipes thoroughly, so that you know what to do step by step, how to schedule yo
ingredients and utensils to make the cooking easier – and succeed at it! The table
cooking mistakes which many of us make.

Mistake	Effect
Overcrowding the pan	Instead of frying, your meat and fish be obtain that lovely, crunchy crust
Adding ga eamy	A dish which is slightly burnt and bitter
Flipping th d too often	Fish is likely to overcook and fall apart, a crunchy crust
Adding wet greens to a pan full of hot oil	The oil splatters around and may burn y instead of frying, and you end up with a
Breading the food improperly	The breading falls off. Next time, dip th and then in breadcrumbs – this way the piece of food.

Check your understanding: The most c
cooking and how to prevent t

1. Why should garlic be added to a dish at the end of cooking?
   a) to make the aroma less intense ☐
   b) to improve the texture of the sauce ☐
   c) to improve the appearance of the dish ☐
   d) to make sure it doesn't burn and spoil the dish ☐

2. Which method can prevent fruit from sinking [illegible] bottom of the ca
   a) coating it with breadcrumbs ☐ b) washing it tho
   c) coating it with flour ☐ d) cutting it very

3. What can cau[illegible] to become lumpy?
   a) ve[illegible] the butter ☐ b) lack of agitatio
   c) too much added salt ☐ d) too much add

4. State three issues which can occur when making a cake which are a r
   weighing or measuring of ingredients.

   1 .....

   2 .....

   3 .....

5. Explain scientifically what happens when bread does not rise.

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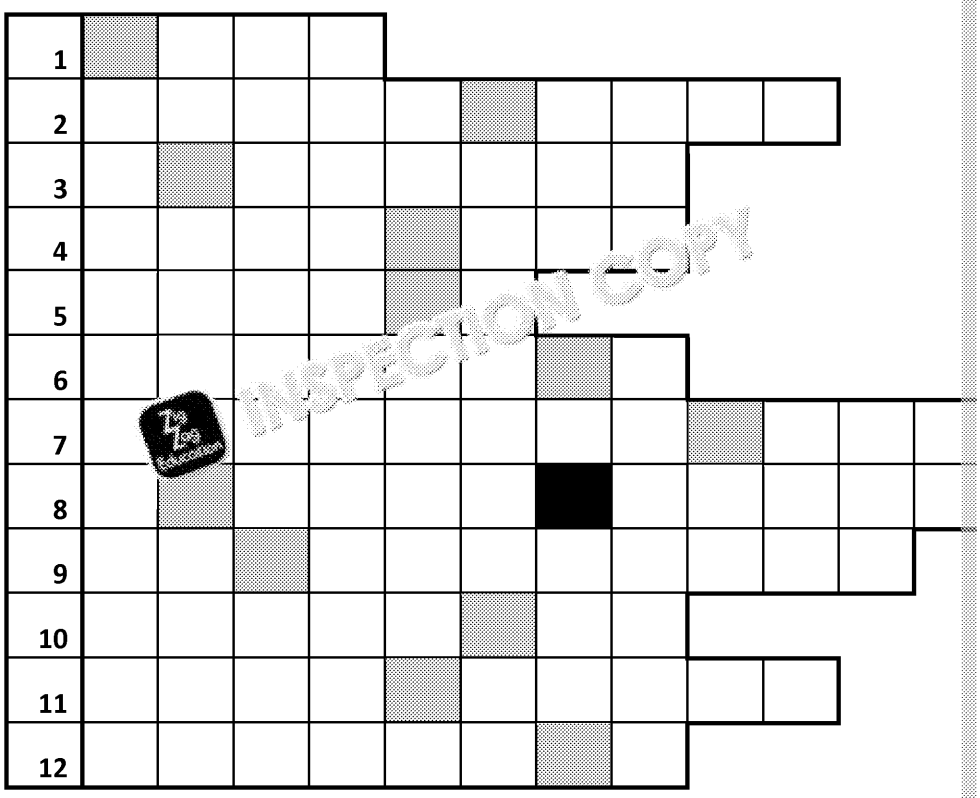
Quiz-ine

Fill in the answers to the questions below to reveal a phrase relevant to food scie
black square is a space between words).



1. Mixture in which gas bubbles are suspended in a liquid (4)
2. Function of fat in pastry making (10)
3. Discolouration of fruit and vegetables caused by enzymes (8)
4. One of the water-soluble vitamins which is lost during cooking (8)
5. Complex protein formed when flour is mixed with water (6)
6. Green-coloured toxin which accumulates in badly stored potatoes (8)
7. Term given to the damage to the chemical structure of protein caused by he
8. Gas produced by yeast, used in bread making (6, 7)
9. Inhibits oxidation in food (11)
10. The action of agitating a sauce to prevent lu ps (8)
11. Type of radiation (waves) use g (10)
12. Cooking method w convection currents and water vapour (8)

The shaded squares reveal this word:

— — — — — — — — — — — — —

Chapter 2: Sensory prope

Overview

In this chapter we will look at sensory testing methods and how our taste buds work when tasting food. We will look at the importance of the senses and how they influence our food choices. We will look at sight, taste, touch and smell. We will explore the different sensory testing methods, including preference tests and grading tests, and learn how to set up a taste panel.

Learning outcomes

After studying this chapter you should be ab

- ❑ understand and describe the importan how they influence food choice
- ❑ describe the different sensory testing
- ❑ explain how to set up a taste panel
- ❑ understand that controlled conditions
- ❑ use sensory testing methods on a wide

Key Terms

Appetis	Tasty: smells and looks nice and encourages a (stimulates the appetite)
Controlled conditions	Conditions, such as lighting, smell and sound, test to ensure that it is conducted fairly and w
Discrimination tests	Tests that are used to detect differences betw
Grading tests	Tests that determine a rank or rating for food
Hedonic scale	A nine-point scale used within preference tes product is liked or disliked
Objective	Factual, unbiased and not based on opinion
Olfactory/olfaction	Relating to our sense of smell
Palate	This refers to the sensitivity of an individual's identify different flavours
Preference test	A test based on an individual's food preferenc (like or dislike)
Profiling	A test to determine characteristics of a food p
Ranking	A test to determine the order of specific chara
Rating	A test to rate a product by providing scores fo
Sensory	Relating to the five human senses (sight, hear
Subjective	Based on personal opinion or taste
Taste panel	A group of testers comprising people who ma gender or ethnicity, to et a specific consu
Taste receptors	Taste buds on our tongues which help us to d
Triangle tests	A test using three samples, one of which is dif
Umami	A savoury taste

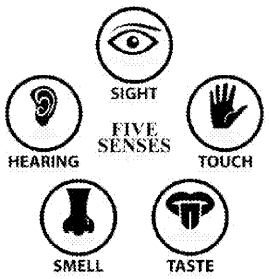
Sensory evaluation of food is an important tool which can be used by food manu
etc. It is used to compare and detect differences between products, analyse foo
responses and preferences of future consumers. Most importantly, it is used to s
be accepted and successful in the market. In this chapter you will learn how our s
and how to set up a taste panel to obtain reliable results.

Organoleptic properties of food and sensory syster

Characteristics of food which can be detected with the senses are called organol
senses in a different way depending on whether the food is raw or cooked, fresh
you learnt how different preparation and cooking methods affect the texture, ta
appearance of food. Now it's time to discover how our senses help us to detect t

The human tongue (and the mouth, although less so) contains **taste recep**
which help us to detect bitter, sour, salty, sweet or savoury tastes. Taste buds he
and influence food choices through our food preferences (what we like or dis

Humans can identify five basic tastes – sweet, sour, bitter, salty and **umami** (a sa
word meaning pleasantly savoury-tasting) – which enable us to develop likes and
senses are important to us so that we can determine differences in taste, appear
can greatly change these features of food – we discussed these changes in detail



Humans have five main senses – we c
evaluate our food. We can see the *ap*
touch the *texture* or firmness of food
food is sour, bitter, sweet, salty or sav
aroma of food. We also use our *hear*
e.g. when eating a crunchy crisp or ap

How the senses help us make food choices

The smell of food may be **appetising** to us and make us want to eat it or be off-putting and make us reluctant to taste it. Our sense of smell is called our **olfactory** sense (the sense of smell is **olfaction**) and it is capable of detecting over 10,000 different smells. Our olfactory system influences our food preferences. Food smells (in the form of tiny molecules undetectable to the human eye) reach the scent receptors in the nose; the olfactory system transmits the signals received to the back of the nose and on to the brain. We then react to the smell by finding it appetising or unappetising. We sniff so that more molecules can be received by special sensory cells at the top of the nose. Our se
connected. A blocked nose affects your sense of taste. Various cooking method
aroma of food, by both the evaporation of water and the addition of herbs and sp
foods have a more intense smell than cold
food the molecules move faster and can re
That's why bread dough doesn't really sm
the whole house with its aroma!

Did you know?

Tiny hairs called cilia are attached to scent receptors and act as filters helping to trap pollen and dust in the nose before it reaches the lungs.

Our sense of taste determines the types o
preference. Some people prefer sweet, s
tooth'), while some people prefer savoury
tolerate bitter or sour tastes, some peopl
contain a bitter compound which also occ
and other brassicas (vegetables from the c
can detect the bitter taste in Brussels sprouts while others are not aware of it.

Texture can also be a deciding factor in whether we find food **appetising** or not. affect the texture of food and make it more appealing; for example, frying helps lacking when you boil a food product. The texture of some foods can be unappe can't tolerate rice cakes or mushrooms. Overcooking food affects the texture an mushy. Texture can also be detected by the sense of hearing – by hearing that a fresh or freshly made, and that also helps us make a decision about whether we

The appearance of food can influence our food choices. If a food *looks* unappeti regardless of texture or aroma. During cooking, the appearance of food can char and become sponge-like, but spinach leaves will shrink and become limp. Where taste – regional dishes such as haggis from Scotland or jellied eels from the East taste due to texture, appearance and taste.

Things to think about (2.1)

cu a blocked nose affects our sense of taste.

Apply

List three foods with a bitter taste that some people would find unappetising.

Revisio

Remember y know how t work when and that tast on the tongu whole mout

Research

Look up three foods in the UK that are associated with a particular region (e

Sensory testing methods

Sensory testing is about evaluating a range of food using taste, texture, appearan
preparing or cooking enables us to determine whether it needs to be sweetened
salt). Not everyone shares the same sense of taste, and some people prefer a sa
way, some people prefer spicy food while others prefer milder tastes. To evalua
sensory testing methods, including the following:

	Preference Tests
Paired preference	**Preference tests** are used within consumer marketing
group of consumers prefer a certain food product com
manufacturer to see whether a new product will be su
Because a large number of
consuming and cost
and request
Hedonic	**hedonic scale** is used in order to rate h
likes a product on a sliding scale of 'like extremely' t
sometimes referred to as a likeability test.
	Discrimination Tests
Triangle	This test involves three samples – two of the same san
The tester must try to identify the different sample (oc
	Grading Tests
Ranking	This type of test attempts to detect differences in simi
sweeter than another product? The tester must sort t
sweetness, starting with the sweetest and ending with
Rating	**Rating** tests are used to detect characteristics betwee
example, testing whether a reduced sugar product tas
full sugar product. The tester uses a scale starting at 'd
lot'.
Profiling	A **profiling** test is also referred to as a star test and is u
characteristics of a product using, for example, a five-p

Did you know?

Subjective means that the result is based on an individual's opinion or

Objective means being factual, with the result not being based on pers

Preference tests

Preference tests are used to find out which product a panel of testers prefer / lik
subjective.

Paired preference tests

In the following test, a tester is required to indicate which of the products they p
personal taste and opinion (subjective).

Sample 1

Sc

Sample 2

Score: 4

These products
salted potato cr
indicate their pr
the hedonic sca

Hedonic scale

The nine-point hedonic scale is used to determine the *likeability* of a product.

Nine-point hedonic scale

9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

In the above test, th
Sample 1 (9 = like ex
dislike Sample 2 (4 =

Preference tests are
characteristics but a
consumer's prefere
A preference test is

Discrimination tests

Discrimination tests are **objective** tests which are used to detect and identify diff
food products.

Triangle tests use three samples – two of which are the same product and one of which is different or the 'odd one out'. Out of the three samples, the tester must decide which sample exhibits an overall difference from the other two samples. In the example on the right, Samples A and C are the same and Sample B is the odd one out. The tester needs to identify whether sample B tastes significantly different.

Sample B ✓

In this test, the tester has detected a difference in taste in Sample B due to the low fat content.

Grading tests

Grading tests use **ranking**, **rating** and **profiling** methods. These tests are **objecti** ready-salted crisps are being tested and then ranked in order of saltiness.

Sample C

1st Saltiest

Sample A

2nd Salty

Sample D

Slightly salty

Ranking – order of specific characteristics of similar products (which is sweeter, w test, Sample C is the saltiest and Sample B the least salty.

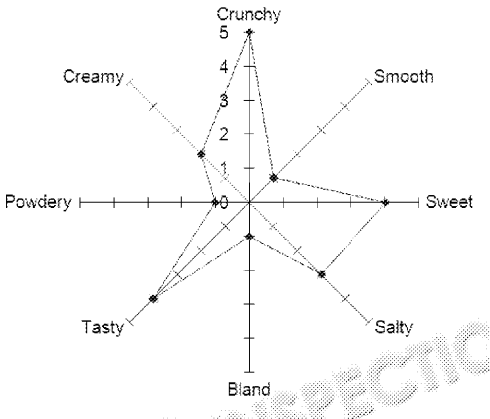
Rating – ho ou te this product in terms of specified characteristics?
In the follow st, four packets of crisps are rated using scores for saltiness, cr

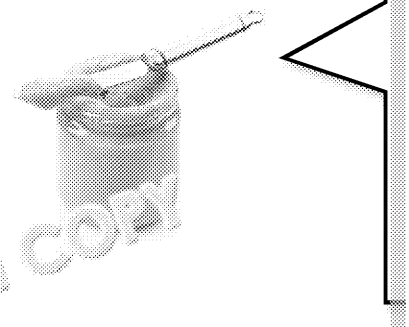
	Score (out of 4)			
Characteristic	**A**	**B**	**C**	**D**
Saltiness	4	1	4	2
Crunchiness	2	1	3	1
Appearance	2	1	3	4

In t sco the am the

Saltiness scores: 1 = Right amount of salt, 2 = Slightly too salty, 3 = Too much sa
Crunchiness scores: 1 = Good crunchy texture, 2 = Only slightly crunchy, 3 = Too c
Appearance: 1 = Consistent golden appearance, 2 = Appearance OK but inconsis

Profiling is used to evaluate the characteristics of a product using a five-point sca jar of crunchy peanut butter is tested using a five-point scale for the intensity of e (crunchiness, sweetness, tastiness, etc.).





Taste panels

The type of **taste panel** used will depend largely on the target consumer, e.g. age, gender, ethnicity, income bracket and leisure pursuits. For example, a product aimed at retired consumers would use a taste panel comprising testers of this age group, and a product aimed at toddlers would comprise a taste panel of young mothers. Some food products are targeted at consumers who are interested in fitness and health, such as energy bars or protein drinks, and so the taste panel would comprise testers with the same interests. A tester is usually a typical example of the intended consumer of the product (e.g. a vegetarian wouldn't be asked to test a meat pro usually has good 'taste buds' with the ability to detect subtle differences in the t style food that is targeted at a typical British consum , such as curry, may not b Indian curries, and the testing panel will refl th by using typical potential co

Controlled conditions

Controlled conditio that the tests are reliable and credible. Conditions lighting, te ur and sound controls.

- The room temperature is controlled so that the testers are not too cold o and can focus on the task at hand.
- Sometimes lighting is controlled in order to disguise the appearance of fo
- Quiet conditions, usually booths, are used with no smells to distract the t
- Glasses of water are provided to sip between tastes (to cleanse the **pala**
- In some tests, testers are required to wear blindfolds so as not to be dist the food.

Test sheets for testers to record their results are supplied.
It is also very important to properly prepare the food samples. When preparing a

- use food samples of roughly the same size
- serve food samples on the same type and size of crockery – it is best to us
- serve food samples at correct temperatures – e.g. ice creams should be s be served warm
- use a neutral-tasting food carrier, if one is needed; unsalted rice cakes are a good example
- code your samples with random numbers rather than simply naming them so that testers do not know which sample is which

Things to think about (2...

Discuss why c le conditions for taste panels are important.

Appropriate descriptive terminology

When describing a food sample, you can't just say that it is 'good' or 'nice'. This doesn't really say much about the food and simply shows your subjective preference towards it. Rather than using generic terms, you should try to find words which describe the food accurately and in detail.

The table below shows some of the words you can use when describing various aspects of a food product.

Aroma	*Aromatic, floral, pungent, perfumed, acrid, musty, fragrant, bla fishy*
Texture	*Brittle, rubbery, close, sandy, tacky, st tender, soft, gritty, c moist*
Taste	*Sweet, bitter, zest c s, spicy, weak, savoury, rich, chees mild, milky mellow*
Appearanc	*fizzy, open, coarse, firm, flaky, lumpy, mushy, runny, rnt, blackened, golden*

Skills

1. Prepare a basil-flavoured oil to be used with Mediterranean roasted veg flavoured oil to use with a Chinese stir-fry.
2. Set up a taste panel for a preference test that will test your two oils.

Apply

1. Prepare two similar samples of food (but one must be sweeter or saltier, Ask a friend to indicate their preference using the hedonic scale.
2. Prepare one sample of a food and try to assess it using the profiling test. H of that food can you assess?

Check your understanding: Sensory

1. Which of the following statements is CORRECT about preference te
   a. It is a test to judge characteristics of food.
   b. It is a test to see whether a consumer likes or dislikes food.
   c. It is a test to place food in a particular order.
   d. It is a test that uses a triangle.

2. Which of the following statements is TRUE about setting up a sensor
   a. The tests must be conducted under controlled conditions.
   b. The tests must be conducted in a test kitchen at home.
   c. The tests can only be conducted by an experienced tester.
   d. The tests are conducted using the same conditions for every test

3. Which of the following refers to olfaction?
   a. sense of hearing ☐ c. sense of touch
   b. sense of smell ☐ d. sense of taste

4. Which of the following words describes a result which is based on an or taste?
   a. objective ☐ c. injective
   b. subjective ☐ d. projective

5. Explain how you would set up a taste panel for a preference test of m based protein drinks.

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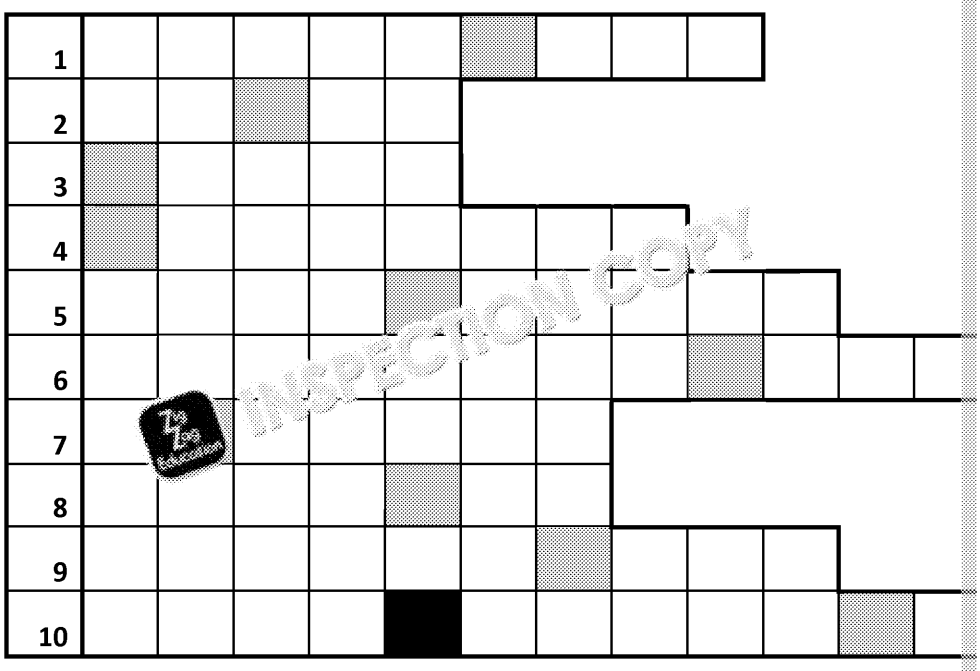
Quiz-ine

Fill in the answers to the questions below to reveal a word relevant to sensory p
squares (the black square is a space between words).



1. Sensory system used to detect aromas (9)
2. The savoury taste characteristic of meat and cheese (5)
3. One of the five senses, used to assess the appearance of food (5)
4. Sensory testing method used to identify the odd one out (8)
5. Relating to or based on individual opinion (10)
6. Characteristic of food which affects the sensory organs (12)
7. Sensory testing method which puts food samples in an order (7)
8. Scale used to assess how much a person likes or dislikes a food (7)
9. Sensory testing method which uses the scale from clue 8 (10)
10. Chart which displays various characteristics of a food product (4, 7)

The shaded squares reveal these w

Chapter 3: Food safet

Overview

In this chapter we will look at the effects of microorganisms and enzymes and their role in food spoilage. We will also explore different sources of bacterial contamination and food poisoning, learn how to recognise and prevent them. Issues with high-risk foods and the danger zone temperatures will be addressed, along with using temperature probes to check that food is cooked thoroughly. We will also explore the use of microorgani[illegible]od production.

Learning outcomes

After studying this chapter you should be able to do the f

- ❑ understand and describe the growth conditions th
- ❑ list the conditions needed for microorganisms to g
- ❑ identify high-risk food items and understand what
- ❑ recognise the signs of food spoilage such as mould
- ❑ describe the measures for control of enzymic actio
- ❑ explain the role of micro[illegible]ganisms in food product
- ❑ make informed [illegible] when buying food
- ❑ [illegible]ly the storage conditions for vario
- ❑ [illegible]ify the different sources of bacterial contami
- ❑ list the main sources of bacterial food poisoning
- ❑ recognise the main symptoms of food poisoning
- ❑ explain different ways of preventing cross-contam

Key Terms

Aerobic bacteria	Bacteria that require oxygen to live and multiply
Allergen	A substance, e.g. an ingredient in food such as nut which can cause an allergic reaction in susceptible
Anaerobic bacteria	Bacteria that do not require oxygen to live and mu
Blanching	The process of plunging food (usually vegetables a briefly, then draining and refreshing it in cold wate process
Blast chiller	A machine used in commercial kitchens to cool foo cold air over it
Cold store	A room or large cupboard area where stored food
Cross-contamination	The means by which bacteria are transferred from utensil to another
Danger zone	The temperature range in which most food poison multiply: -5 °C to 63 °C
Date marks	'Best before' dates refer to the date at which the q 'Use by' dates are used for perishable foods and re
Dietary reference value	Estimated requirements fo[illegible]rgy and nutrients f people (e.g. toddle[illegible], [illegible]e girls, adult men)
Dry food area	A dry, [illegible]ated room in which food can be s
Enzyme	[illegible]ological catalyst usually made from protein wh brown
Fermen	The breakdown of sugar performed by bacteria an carbon dioxide
Friendly bacteria	Used in probiotic products designed to improve gu
Health claim	Statement on food packaging which refers directly the consumption of a given product
High-risk food	Food which has ideal conditions for bacterial grow high-protein food OR ready-to-eat food that will e of pathogenic bacteria and does not need any furt

Key Terms

Microbial spoilage	See spoilage bacteria
Microorganism	An organism (e.g. bacterium) that is too small to se needs to be viewed under a microscope
Non-mandatory information	Information which may appear on food labelling th (e.g. serving suggestions)
Nutrition claim	Statement on a food packaging which refers to ber product
Oxidation	Process that occurs when f s cut and exposed browning)
Pathogenic bacteria	Bad bacte h can cause illness. A **pathogen**
Perishable	ood with a limited 'use by' date that will not 'kee
Personal ne	Ensuring personal cleanliness to prevent bacterial
pH scale	Measures acidity/alkalinity: 7 = neutral, <7 = acidic
Spoilage bacteria	Bacteria that make food 'go off'
Spore	A reproductive cell capable of developing into ano fission. The means by which mould (and other fun
Stock rotation	Items are prioritised subject to a principle of 'first items already in stock are used before freshly deliv
Work surface	A surface such as a table or counter top on which f
Thawing temperature	The recommended temperature at which food is t
Temperature gauge	A gauge positioned on the outside of appliances th seen and recorded
Temperature probe	A handheld device that is used to measure the ten thickest part of the food to check its internal temp

The knowledge and ability to apply food safety principles when buying, storing, c
to ensure that the food is nutritious and safe to eat. Correctly handling food prod
and cross-contamination. Let's have a look at what causes food spoilage and how

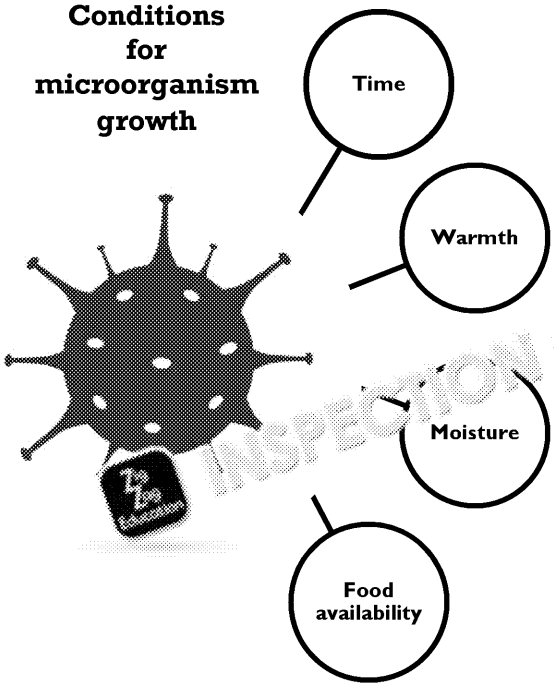
Microorganisms in food (bacteria, mould and yeast)

An organism is an individual animal, plant, fungus, bacterium or single-celled life f
A **microorganism** is an organism that is too small to see with the naked eye and needs to be viewed under a microscope. Microorganisms can be carried on food or in water and can cause food poisoning. Microorganisms can also be used in food production; for example, bacteria in bio-yoghurt, yeast in bread and moulds in blue cheese.

The role of microorganisms in food production

Microorganism	Good	
Bacteria	**'Friendly' bacteria** are used in probiotic products designed to improve gut flora.	Microbial ba (**spoilage ba** disease (**patho**
Yeast	This is used in bread making. Yeast produces carbon dioxide to make dough rise. Yeast is also used to make fruit ferment and is used to create alcohol.	A single-celle fungus famil problems in cause food s
Mould	Mould is used in cheesemaking to improve flavour (blue cheese).	Mould can g making them

Microorganisms need certain conditions in order to grow and multiply. These co



Where are

Microorganis
- rubbish
- clothing
- soil
- food p
- water
- air
- dust
- saliva
- animal
- dandru
- tears
- phlegm
- pus
- blood
- urine a
- skin ce

These will be discussed in greater detail later on in this chapter.

Bacteria

There are 'good' and 'bad' bacteria – good bacteria are also referred to as **'friendly' bacteria**, and they help to maintain good gut flora (complex microorganisms that live in the digestive system). **Good bacteria** are needed to help digest food and also to make yoghurt and probiotic products.

Spoilage bacteria make food 'go off', rot or spoil. This is referred to as **microbia** sometimes smell the changes in the food caused by these microorganisms. Micro bacteria, yeasts and moulds.

Bad bacteria which can cause illness (food poisoning) are referred to as **pathoge** lead to bacterial infections such as *E. coli*, *Clostridium perfri...ens* and *Campylob...* are bad bacteria which can cause illness and cann... s...n or smelled in food. Pathogenic bacteria can come from th... oli...ng sources:

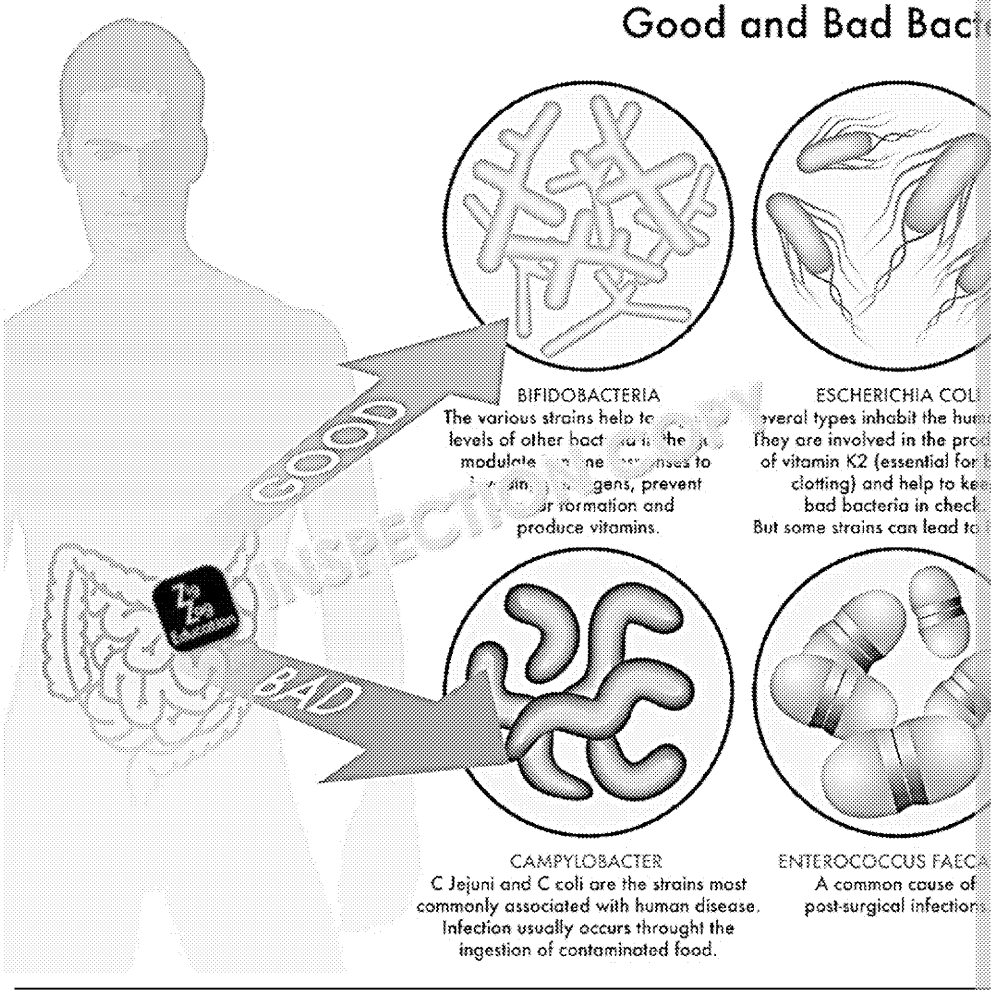
- Raw foods
- Pests and domes...
- Peo...or ...hands, hair, nose, throat and infected cuts)
- Air ...st
- Dirt and soil (unwashed vegetables and salads)
- Food waste

Research

Research food poisoning symptoms and causes on the NHS website using the ... **zzed.uk/8228-nhs-food-poisoning**

Things to think about (3.1)

Think about who is most at risk from food poisoning, and why.



Yeast

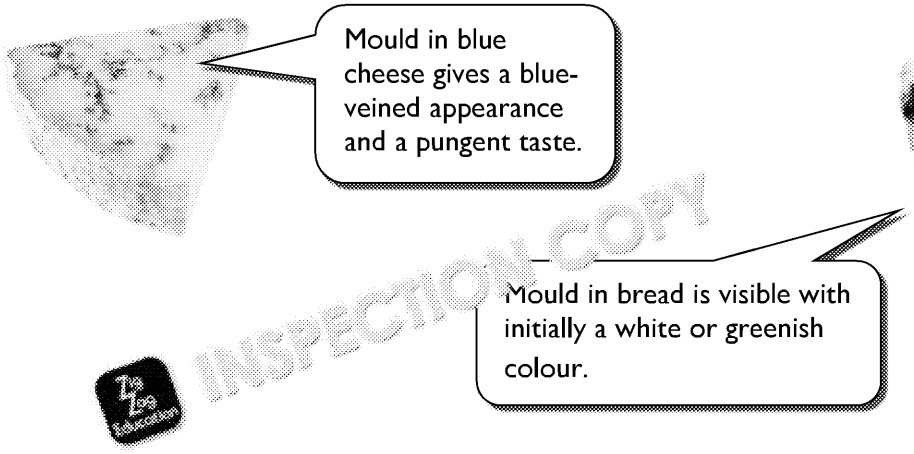
Yeast is a microscopic fungus used in **fermentation** of food products such as brea
Fermentation is a process caused by combining yeast and sugar. Yeast turns sug
'rise' by producing carbon dioxide (CO_2) gas. Yeast can cause digestive problems
cause **food spoilage** through fermentation (as yeast uses up sugar and produces
becomes sour and slightly fizzy, which is not necessarily desired in most foods).

Yeast has an important role in bread making – it makes dough rise, it strengthens the bread dough and its fermentation develops flavour

Mould

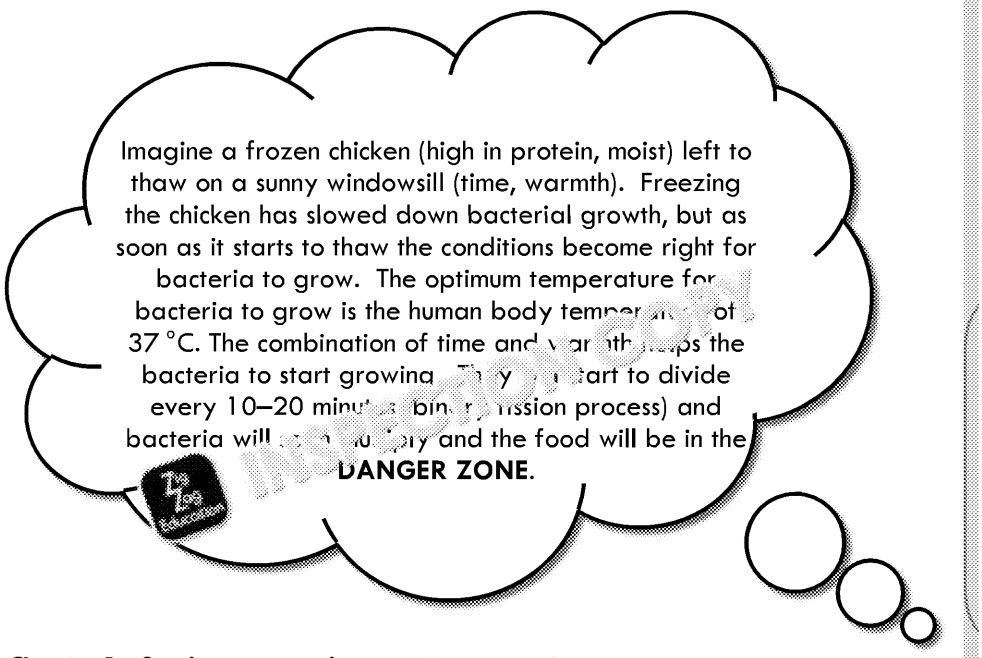
A mould is a fungus that reproduces via **spores**, which grow on organic matter, s
conditions are present, i.e. warmth and moisture. Mould is used in the productio
Stilton, Gorgonzola and Roquefort and produces a blue-veined appearance. Blue
taste. Mould in food produces enzymes, which break down the food and cause f
eat. Mould can also cause allergic reactions and produce harmful toxins called **n**

Mould in Food Production



The role of temperature, moisture, pH and time

To survive and multiply, bacteria need certain conditions such as *time, food* (pref
warmth and moisture.



Control of microorganisms – temperature

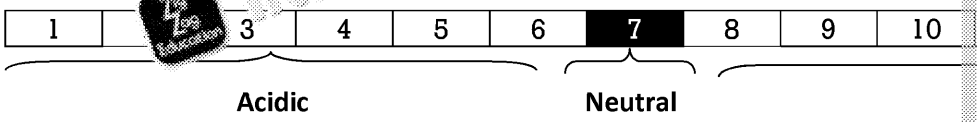
Bacteria can multiply at temperatures between five degrees centigrade (5 °C) and
63 degrees centigrade (63 °C), with the optimum temperature being 37 degrees
centigrade (human body temperature). Even if cooked at high temperatures, **hig
risk** food (e.g. any food that has been cooked and will not go through any other
procedure to kill bacteria, such as a chicken or egg mayonnaise sandwich) passes
through the **DANGER ZONE** as it cools down. *Between the temperatures of 5 °C a
63 °C is where bacteria can grow and multiply.* Bacteria can be killed off at
temperatures of at least 75 °C in the centre of food. If reheated, the centre mus
least 82 °C.

Although bacteria can be killed at temperatures of 75 °C or above, at temperatur
slow down ready to grow and multiply once conditions are right, i.e. the food pa
Freezing food at the recommended temperature of -18 °C does not guarantee th
it will slow them down. Bacteria may still be present and given time, warmth, m
of these elements, bacteria start to grow and multiply.

Control of microorganisms – pH

pH refers to neutrality, acidity and alkalinity, and it plays a pa t in controlling mic
used for centuries (such as in pickling) to control mic o ni ms in food. Some
pickled foods have a pH of 4.8 and below (acidic). O the pH scale, 7 is neutral (p
acidic and over 7 is alkaline. Lemon ju a vinegar are acidic.

pH Scale



Litmus test

Litmus paper allows you to test the acidity of food yourself. A pH test kit contains
litmus paper and a colour chart. The litmus paper is dipped into the food and
then compared to the colour on the pH chart to determine its acidity or alkalinity.
Litmus paper changes colour depending on the pH. It is red when acidic and blue
when alkaline. If you dip blue litmus in an acid such as lemon juice, it will turn red
you dip red litmus paper in an alkali such as baking soda dissolved in water, it wil

Control of microorganisms – water availability

Bacteria, mould and yeast need moisture in order to survive, and the availability of water within a food item determines whether these microorganisms can exist or multiply. Dehydrating or desiccating foods helps to inhibit moulds, yeast and bacteria. This is why drying foods can be an effective preservation technique that helps prevent spoilage and increases
Preparation for drying may include washing and blanching fruit and vegetables b
begin to grow on partly dried foods. Some nutrients, such as vitamins C and A, c
The food preservative sulphur dioxide is sometimes added to dried foods to prev
apricots) and to prevent loss of vitamins. Sulphur dioxide is listed as an allergen
reaction in some people.

Appl
to
the

Preserv ig ..., such as fruit, through
... used for centuries. Examples of d
...isins, sultanas, nuts, apricots and tom
include:

- sun-drying
- oven-drying or microwave-drying
- dehydrators or air-dryers

Research

Look up house rules on temperatures and bacterial contamination on the G
Standards Agency website using the redirect URL **zzed.uk/8228-food.gov**

Things to think about (3.2)

Why is the optimum temperature for human pathogens 37 °C?

Signs of food spoilage

Spoilage refers to decay and decomposition of food items. Food that has decayed or is in the process of decaying may lose some or all of its nutritional value and not be fit to eat. Correct storage of food can help to prevent spoilage. Enzymic action causes ripening (e.g. of fruit such as bananas) and browning of some fruits and vegetables. Yeast reacts with sugars to cause **fermentation**. This process can occur with fruit such as grapes which contain naturally occurring sugars and yeast on their skins. Yeast and mould growth are signs of age and spoilage. Other fruits that can be affected by yeasts and moulds are blueberries, strawberries, blackberries, citrus fruits.

Spoilage can be slowed down by:

- preserving food
- handling food corr
- storing food at correct temperatures

Although you can't see **pathogenic bacteria** with the naked eye, **spoilage bacteria** cause a process of decay that can be recognised in the following ways:

- the colour of food – e.g. browning
- the smell
- the texture – e.g. wrinkling or shrivelling
- the taste
- mould growth

Bacterial growth can be prevented by using preservatives such as salt and sugar o lemon juice. Preservatives may also be used in food, such as sulphur dioxide for c browning) – sulphur compounds may appear in the ingredients list as sulphites (E metabisulphite, potassium bisulphite, sodium metabisulphite or sodium sulphite may cause an allergic reaction in some people. To prevent spoilage, food preserv as the following:

- curing, salting and pickling
- smoking
- vacuum sealing
- heat treatment (e.g. UHT) and pasteurisation
- low temperatures
- drying
- irradiation

Research

Look up the general legal regulation ding food law at the Government Agency website using the re zzed.uk/8228-food-law

Prepare fruit and vegetables to prevent yeast and mould growth

Some fruit and vegetables sustain yeast and mould more than others (e.g. grapes) and need to be prepared carefully in order to prevent their growth. Preparation (skinning fruits and vegetables (yeast and mould growth is contained on the skin) a deter **microorganism** growth.

Skills

Skin a tomato

(take care with hot water and sharp implements)

Using a knife, slice an X on the base of the tomato. Place the tomato in a bowl of boiling water to loosen the skin, and leave until skin starts to curl around the X. Remove tomato and cool under to stop the cooking process (use a spoon) and then peel. **S2**

Skill

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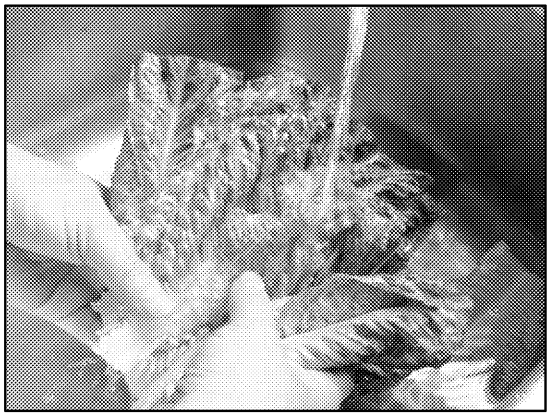

Soil contains **patho** present on unwashe grains, such as rice a vegetables helps to

After washing fruit a chilled to deter **mi** some exceptions be

Di

Root v potato stored

Did you know?

Some fruit has to be ripe before placing in a refrigerator as chilling stops the fruit from ripening (e.g. melons, oranges and tomatoes).

Apply

List three food items that quickly show signs of decay with age.

Skills

De..onstrate washing and chilling fruit/vegetables.

2. Demonstrate different ways of pre control enzymic browning.

Things to think about (3.3)

Why do some foods show signs of spoilage before others?

High-risk foods

Bacteria prefer moist foods that are high in protein and as they exist where there is warmth, moisture, food and time, given one or more of these conditions they can start growing. Foods in this category include meat, poultry, fish, shellfish, eggs, milk and dairy products. High-risk foods are foods that have been cooked and left to cool down to be served cold later. High-risk food will not go through any other process to kill bacteria. Hot foods should be kept hot and cold foods should be kept cold. Bacteria numbers can begin to rise again once food is thawed or reheated.

H
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Th
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m

When dealing with high-risk foods, you should ensure th

- your hands are clean throughout th y h handling is kept to a minim
- stored food is kept covered
- the temperature is kept within the danger zone of between 5 °C and 63 °C
- raw f ar h sk food are kept separate – *clean utensils after chop bac ansferring from the meat to the board or surface and utensils. cont ination with ready-to-eat foods. Store raw meat on the bottom s dripping onto other foods.*

Be extra vigilant when dealing with the following high-risk food:

- cooked meat and poultry – e.g. chicken drumsticks, burgers, sausage rol
- milk and other dairy products – e.g. ice cream or products containing cooke
- shellfish and seafood – e.g. prawn cocktail, fish pâté, scampi
- cooked rice (the longer rice is left at room temperature the more likely t or toxins making it unsafe. See more on p. 84).

Chicken and poultry should never be washed before cooking as water droplets fr bacteria onto work surfaces, utensils or food.

Danger Zone
Food is in the **danger zo** n it starts to cool and the temperature is between 5 °C and 63 °C.

Ready-to-eat foods
Ready-to-eat foods such as a chicken sandwich, b egg or sausage roll are referred to as **HIGH-RISK** because they have passed through temperatures between 5 °C and 63 °C and will not be subject to other process that will slow down or kill bacteria

Check your understandin
Microorganisms (food spoil

1. Which of the following statements about **enzymic browning** is inco
   a. It causes ripening of fruit. ☐ b. It causes discolouration of
   c. It is accelerated by oxygen. ☐ d. It causes the pH to becom

2. Which of the following methods would NOT help to deter microorg
   tomatoes?
   a. Skinning and chilling ☐ b. Seeding and washing
   c. Storing at room temperature ☐ d. [illegible]/ashing and chilling

3. What temperature is referred to as the DANGER ZONE?
   a. Between 5 °C and [illegible] ☐ b. Less than 5 °C
   c. More tha[illegible] ☐ d. Between 5 °C and 1

4. [illegible] of the following statements about preserving food is FALSE?
   B[illegible]al growth can be prevented by using…
   a. vinegar ☐ b. salt
   c. pepper ☐ d. sugar

5. Describe three ways in which temperature control can prevent food
   bacteria and/or enzymes.

   1 .....

   2 .....

   3 .....

6. Explain how microorganisms such as pathogenic bacteria can cause fo

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Bacteria, yeast and mould are not always bad for us – in fact, varieties of all three ca
foods such as bread and bread products (flatbread, bagels, pizza or calzone), soya pr
to name a few. It is important to remember that only selected species are used in fo
cause more harm than good. Microorganisms in food production are responsible for
texture of the given product, and help to improve its shelf life and nutritional value, a

The role of yeast, mould and bacteria in food produ

Various microorganisms can be used in food production for different reasons. Fo
raising agent in baked goods and to ferment sugars int e a ol in the productio
species of bacteria can be used in the manufactu ng f airy products, but also t
Mould is used in production of dairy p e t ucts and sauces. Sometimes mul
production of one product, as the co ination allows to obtain the desired effec

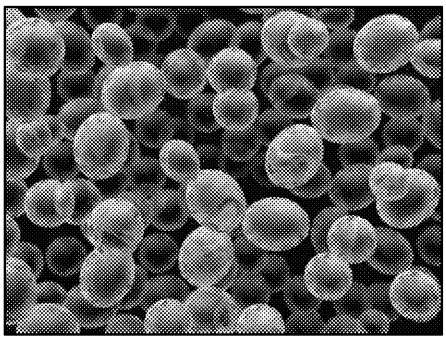
How is ye e bread making?

Yeast is a ty ungus used in bread making to make bread dough rise. Yeast w
which, in turn, release carbon dioxide. It is the carbon dioxide that makes the dough rise. The type of yeast used in bread production is referred to as baker's yeast (or brewer's yeast in alcohol production). The strain of yeast is *Saccharomyces cerevisiae*. Yeast can be isolated from the skins of fruit. Yeast can also be produced commercially for bread making.

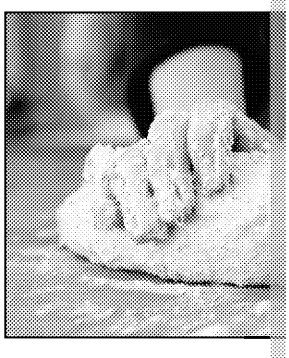
Did

Blue m
on lem

Baker's yeast breaks down sugars and releases carbon dioxide



*Carbon dioxide makes d
bakery*



How is mould used in blue cheese?

A culture of the blue mould *Penicillium* is used to create the blue-veined appearance of 'blue' cheeses such as Roquefort (from shee milk), Gorgonzola and Stilton (from cows' milk). The mould is used b cheese makers to enhance flavour and produce a pungent taste and s It does this by breaking down compounds (fats and proteins) wi the cheese and releasing **enzymes**. This process also lowers the p ic level.

Mould requ gen for it to grow. Air holes within the cheese act as pockets which the mould can spread (sometimes bacterial cultures are added to create th holes).

The *Penicillium* mould culture is found naturally (blue mould grows on lemons) and is also commercially manufactured in laboratories. The *Penicillium* mould is non-toxic, unlike other moulds that grow on food, and so can be safely used in food production without the risk of producing mycotoxins. To prevent further mould growth (from oxygen) once 'blueing' has occurred, the cheese is wrapped in foil and placed at a lower temperature.

How is bacteria used in yoghurt?

The bacteria used in yoghurt are *Streptococcus thermophilus* and *Lactobacillus b* the sugars in the milk (called lactose) and create lactic acid. This lowers the **pH** o process makes milk curdle, thereby producing yoghurt (a type of **fermentation**). **'friendly' bacteria** as they aid digestion and help to improve gut flora. Products referred to as 'probiotic'.

How microorganisms are used in production of meat products

Some fermented meat products such as Spanish chorizo, Italian salami or French of 'good' bacteria and mould. These are added to raw, minced meat, where they reactions. The different species and varieties of microorganism have different fu

- *Micrococcus* bacteria transform nitrate to nitrite – as a result, this the m colour, and the sausage is safe to eat.
- *Lactobacillus* bacteria lower the pH of the sausage, making its flavour sli texture (through denaturation of protein in meat) – the ready sausage is
- *Penicillium* moulds create a white coat on the surface, which is desirable

The 'good' bacteria and moulds also help to protect the sausage from the harmful varieties, increasing its shelf life. The fermented m is then mixed with salt and spices, put into natural or arti ngs, and hung to dry and mature. During the last step, s es can also be smoked (this is popular for Germ a Bulgarian fermented sausages, for example). The variou on methods used during production of these me ea ey can be safely stored even outside the fridge.

Fermen
coat dep

Apply

Read the article at **zzed.uk/8228-raw-sausages** and list all of the preserv the production of fermented sausages. Explain why low temperatures have to

Microorganism use in the drinks industry

When yeast ferments sugar, it produces not only carbon dioxide (which is very helpful in baking), but also ethanol. The reaction was used in China in 7000 BC to produce wine from fruit, honey and rice. Today yeast is widely used in the production of alcoholic beverages such as beer, cider, wine and champagne. During production, the sugar-rich ingredients are first prepared and pumped into large containers. There, specially grown yeast species are added – they transform the sugar from fruit or barley, and produce alcohol and carbon dioxide. That's why most of these beverages are fizzy!

Other foods made with the use of microorganisms

Fermentation has been used as a popular way of preserving foods around the world from ancient times – even though people didn't understand the mechanisms behind it. Today we know that fermentation is caused by probiotic bacteria, mould and yeast.

Champag
in thin

The products made with fermentation usually have a characteristic flavour, aroma and te
These prod lude:

- soy sauce, Worcestershire sauce, fish sauce, Tabasco
- pickles (e.g. pickled gherkins)
- sauerkraut and kimchi (Asian-style sauerkraut)
- milk beverages, e.g. kefir, ayran, *Actimel®* and *Yakult®*
- kombucha (beverage made of tea, sugar, yeast and bacteria, drunk instead of fizzy drinks)
- tempeh and miso paste (made of fermented soya beans)
- cocoa beans (yes, they also undergo fermentation before being turned in chocolate!)
- Pu-erh tea
- olives
- fish preserves, e.g. anchovies in the Mediterranean region and surströmming in Sweden

Skills

1. Demonstrate the effect of yeast in making bread rise.
2. Make a bread dough, and finish and shape it for use in pizza, breads, etc.

S7

Things to think abo

Think of other fo that go through a fermentation process.

Check your understandin
Microorganisms (food produ

1. Which of the following mould cultures is used for making blue cheese?
   a. Mycotoxins ☐ b. *Penicillium*
   c. Spores ☐ d. Lactose

2. What is the name for sugars in milk on which bacteria feed?
   a. Fructose ☐ b. Lactose
   c. Sucrose ☐ d. Maltose

3. Lactic acid causes which type of proce[illegible] to create yoghurt?
   a. Boiling ☐ b. Curdling
   c. Whipping ☐ d. Setting

4. D[illegible]be [illegible]ction of bacteria in cheesemaking.

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5. Explain how the processing of salami helps to make it microbiologicall[illegible]

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Buying food

Buying food seems an easy job. You go to the shop, choose what you need, pay a
about it again. How many questions do you ask yourself before deciding whethe
need to know what product you need, in what quantity, whether it is fresh and o
factors. In this chapter you will learn what to pay attention to when buying food
consumption.

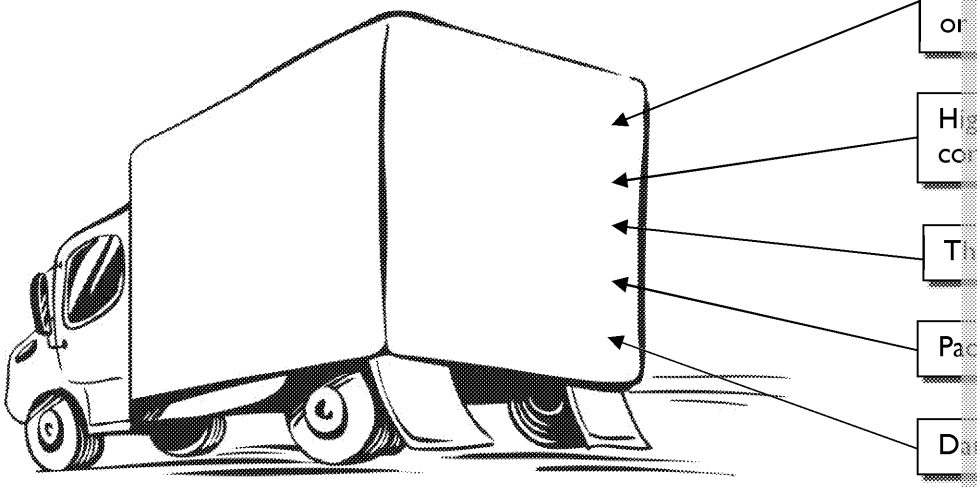
The food we eat comes from both plants (grown in fields, orchards and polytunn
and fish tanks or caught in the wild). The farmers, growers and hunters then sell
food factories, who process it to make food. The food is then transported to supe
whom we are able to buy food to cook the dinner. It is important to pay attentio
is processed, transported and stored, as they can affect its safety and quality.

Deliveries

When raw or **perishable** food is delivered, it should be at a safe temperature (less than 8 °C for refrigerated foods and less than -18 °C for frozen foods). When taking deliveries, the following should be checked:

- **Date marks**
- Packaging
- Temperature

Deliveries should be rejected if food is out of date, if packaging is damaged or if t
The following should be checked:



When storing food after a delivery, the following guidelines should be observed:

- Handle food with care – do not drop food or damage packaging
- Store **perishable** food first
- Store food at correct temperatures
- Do NOT store food on the floor
- Keep food away from pests and be aware of the signs of pests
- Keep storage area clean

Date marks

When checking **date marks**, ensure that you know the difference between 'best b

Best before	
'Best before' dates refer to the date at which the quality of food will be affected. Food may still be safe to eat after this date. So 'best before' dates refer to **QUALITY**.	'Use by' dates are use fish or dairy products. should NOT be eaten. **SAFETY** of the food.
It is illegal to serve or sell food past its 'use by' da	

Storage rotation

When storing food, it is important to use the corre **to e rotation** methods. Food with a short shelf life shou before food with a longer shelf life and it should be s ingly, with items with a short shelf life stored in front of a longer shelf life. Always check the date mark on ing it.

Things to think about (3.5)

Why is storage rotation important?

What to look for when buying food: visual checks

Visually checking the food is probably the simplest way of ensuring that it is fresh make sure that the food looks as it should. The table below will help you to check to buy is OK to use.

	What to look for?
Packaging ***(see more on the next page)***	Clean, whole, undamaged; no unintended holes or te clearly visible
Fruit and vegetables	Not wrinkled[1]; firm; no brown or black stains[2]; undam
Fish	Clear, bright eyes; eyes not sunken; bright red gills; s flesh is firm and shiny; tail is stiff
Meat	Bright colour (not dull) – the shade will depend on th are tightly packed and firm; cuts are smooth, with no firm (not yellow)
Milk and dairy	The lid is not bulging; the milk is not curdled or separ with mould[4]

[1] Passion fruit is an exception!

[2] Occasional soil is OK, as some vegetables keep longer when unwashed.

[3] It is OK in yoghurts and creams, though, (yoghurt separates because during fermentatio out the water; it is natural, and the yoghurt is still safe for consumption – simply shake b the cream separates into two layers – fat and water; as you might already know, fat and process is totally natural – simply shake or stir before using).

[4] This doesn't apply to cheeses such as blue cheese, Camembert or Brie, where mould is

Packaging

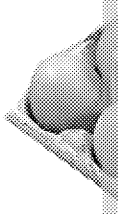
The packaging of food is important as it fulfils many different functions. Food manufacturers have to ensure that the type of packaging used for a chosen product is safe (doesn't interact with the food inside), cheap, light and easy to transport. There are four main functions of packaging:

1. It protects the food from external factors such as light, oxygen, dirt or microorganisms (protection).
2. It informs the consumer about the product (information).
3. It attracts consumers to it and tempts them to buy it (marketing).
4. It increases the shelf life of a given product.

Crisps … This h…

When buying and storing food, you have to pay attention to the following a…

- whether it is whole and intact – holes, tears and other unintended o… microorganisms penetrating through to the food and contaminating it; t… means that the food is no longer protected from oxygen (and oxidation)
- wh… the date marks are clear and easy to read (e.g. not covered by a price sticker), and whether the food is not past its date
- whether the ingredients of the product are safe, e.g. whether it is allergen-free for those who are allergic to a particular food, or whether it is gluten-free for coeliacs
- whether it requires any special storage conditions – usually the producers state if a food has to be refrigerated or frozen
- whether the food is stored correctly in the shop – e.g. yoghurt is in a fridge / cooler area
- whether the lid or packaging is not 'bulging' – this can mean that harmful bacteria, such as *Clostridium botulinum*, have developed in the food, and it is best to throw it away, even if all the other checks were OK.



This cardboard … bumping into e… package you c… a fridge after p…

Reputable supplier

Many people choose to buy foods in well-known places – it is usually difficult to c… make them buy in a totally new shop. This is partly because with time we come t… confidence that the food hygiene rules are obeyed, food is always fresh and of g… etc. When buying food, especially in restaurants and takeaways, it is worth chec… runs a food safety management system and what its hygiene ratings are. It is also… menu provides any information on ingredients and allergens used, as trustworthy… more effort into consumer information and safety. Some places can also display … document, such as ISO or HACCP.

Food labelling

Food labelling can affect an individual's food choice, whether through providing information about the nutritional value, fat, sugar and/or salt content or by listing potential allergens or ingredients that need to be avoided by some people. Some information is mandatory, such as ingredients, and some information, such as serving suggestions, is non-mandatory. Food marketing can influence food choice by using ploys such as 'buy one, get one free' (BOGOF) offers and special offers.

Mandatory information:
Allergenic ingredients
Nutritional information
Date marks

Non-mandatory information:
Serving suggestions

Influences

Mandatory information

Mandatory information on labelling is currently governed by EU (European Union) and Food Standards Agency (FSA) legislation and mostly applies to pre-packed foods from December 2014. Additional nutritional labelling legislation was introduced in December 2016. Mandatory information includes the following:

	Mandatory information on food labels
The name of the food	This must be the real name that meets certain naming standards for marketing purposes. For example, a fat spread made of 50% oil cannot be called 'butter'.
List of ingredients	This must include allergenic ingredients which must be emphasised. Ingredients must be listed by weight in descending value with. This helps to ensure food safety as the consumer can assess them and avoid products which might cause them harm, e.g. plain wheat flour, a coeliac will see it in bold and will know not to
Quantitative ingredients declaration	Referred to as QUID, this provides a percentage of particular product (unless used in small quantities as flavourings).
Net quantity	This is the weight or volume of the food.
Nutrition labelling	From December 2016, food labels must include nutrition information whether health claims have been made on the packaging, sugar content, high caffeine content in drinks must be labelled for children, pregnant women or breastfeeding women. High = over 150 mg per litre). The nutritional value for energy, fat, saturates, protein and salt has to be included either per 100 g or per portion.
Date marks	This includes best before or use by dates (these are discussed
Name and address	This is the name and address of the food supplier. It is very important that a company is responsible for the product, as it helps to trace the source of problems, e.g. a piece of glass found in a tin of mushy peas. Food safety officers can contact the producer more easily and the producer can take steps to avoid further incidents of the incident – or decide to withdraw a whole batch from the market if only one encounters the problem.

Type of treatment used	This treatment could be: freeze-dried, refrozen, dried, sm concentrated. *A label must indicate whether an ingredien* label also has to indicate if the food contains GM organism derived from GM animals and plants.
Country of origin	In some cases it is mandatory to label the country of origi pictures on the packaging could mislead consumers. Cou fresh, chilled and frozen meat from sheep, pigs, goats and
Storage conditions	For example, advice to use a product within a specified nu This helps to ensure the safety of food, as proper storage growth of microorganisms.
Added water	If it is more than 5%, it must be displayed on the label.
Added ingredients	Added proteins, sweeteners, asp e and colourings m Liquorice must also be dis ay d a label. An appropria as well, if applic'e
Lot number or batch numb	This is im, tant for easily identifying all products fro t is discovered (e.g. a piece of glass or a toxic su producer to quickly and effectively remove the faulty bat
Preparatio instructions	These help the consumers to prepare, cook and reheat the for the best experience (in terms of flavour, texture and n

Ingredients: Sugar, Glucose Syrup, Flavourings & Colours May Contain **E102, E110,** E142, E155, E171. **E no's listed in BOLD, may have an adverse effect on activity**
MOWBRAY Confectionery, Blackpool FY3 7UN ENGLA

Example of a mandatory warning on a food label

Non-mandatory information

Non-mandatory information found on labelling includes: serving suggestions, eit picture of the food inside; health and nutrition claims, etc.

A serving suggestion attempts to display the food product in the best possible wa appetising and may also display pictures of ingredients or food not contained in t

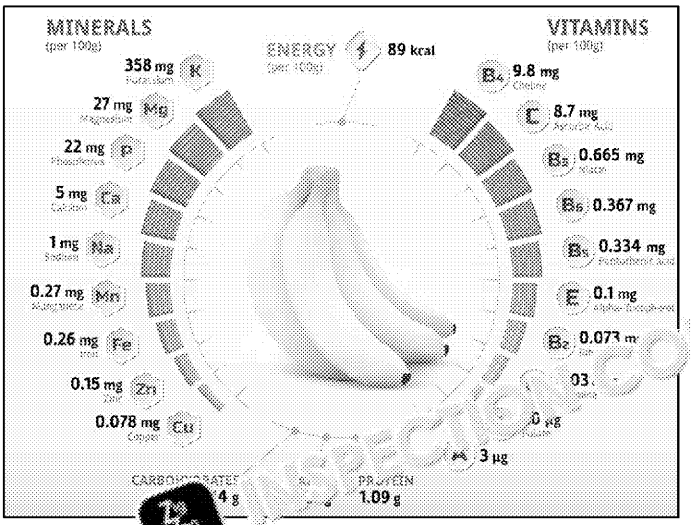
Nutritional labelling

From December 2016 all packaging must include the following nutrition informa 100 ml, or per portion).

- energy (in kJ and kcal)
- fat (in g)
- saturates (in g)
- carbohydrate (in g)
- sugars (in g)
- protein (in g)
- salt (in g)

The ingredients are displayed in the nutritional information per 100 g or per 100 ml.

If a claim has been made about any nutrient within the product, then the amoun
included in the nutritional information.



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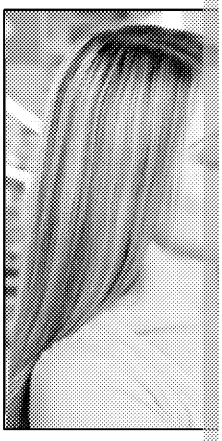
The recommended daily amount stated on nutritional labelling is now called the
GDA – guideline daily amount). The RI values are based on an average-sized fem
active lifestyle. The RI indicates the maximum recommended daily amount that
balanced healthy diet.

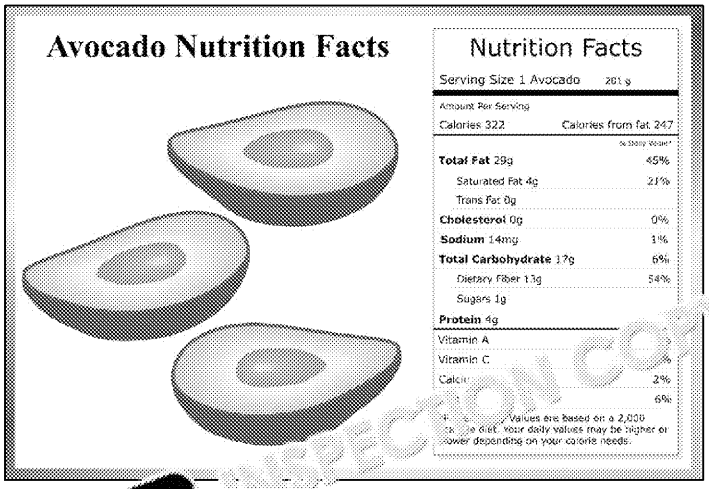
The RI for an average man and woman is:

	Woman	
Energy	8,400 kJ / 2,000 kcal	1
Total fat	70 g	
Saturates	20 g	
Carbohydrate	260 g	
Total sugars	90 g	
Protein	50 g	
Salt	6 g	

An average woman should consume around 2,000 calories and an average man 2,500–2,800 calories per day. An average banana provides 103 calories, which is just over 5 % of a woman's recommended daily calorie intak
The recommended calorie intake f a balanced diet is 45 % to 6 om carbohydrate 1 % from proteins and 20 % % f m fat.



The nutritional information is usually displayed as a percentage of the RI, so an a
the total calories for an average woman.



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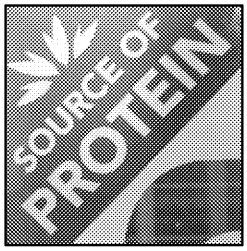
Research

Look up information on nutritional labelling at **zzed.uk/8228-food-labellin**

Nutrition and health claims

Although it is not mandatory to include nutrition and health claims on a food pac
to include them to increase the attractiveness of the product.



Nutrition claims are statements which refer to the content of a specific nutrient in the given food product, e.g. 'source of omega-3 fatty acids' or 'high-calcium'.

A

Health claims are statements which directly indicate the r
the product and health. Health claims have to be based o
approved by the European Commission. An example is 'Ch
digestion through production of hydrochloric acid in the st

Apply

1. Take a look at the nutri[illegible] for a tin of garden peas and list t
protein for half a [illegible] % RI for half a tin.
2. Find out [illegible] how many calories there are in a biscuit, e.g. a
[illegible] for an average adult male.
3. L[illegible] the nutritional information on an average-sized packet (35.4 g)
out how much salt is in the packet. What % RI is this for an average a

Check your understanding: Buy

1. Which of the following statements is CORRECT about mandatory inf labels?
   a. It is compulsory and required by EU food legislation.
   b. It is at the manufacturer's discretion whether to display it or not
   c. It refers to marketing and advertising and is used to tempt consu
   d. It refers to serving suggestions displayed on food products.

2. Nutrition information is displayed as the amount of each nutrient per
   a. 50 g or 50 ml ☐ 100 g o
   c. 100 mg or 100 ml ☐ d. 2,000 k

3. Which of the followin sta ts serves as a reminder about storage
   a. First out ☐ b. First in, first out
   rst on ☐ d. First is best

4. W ch of the following statements is TRUE?
   a. 'Best before' dates are dates at which the quality of food is affect
   b. 'Best before' dates refer to the safety of food, rather than the qu
   c. 'Use by' dates refer to the quality of food, rather than the safety.
   d. Food is still safe to eat after the 'use by' date.

5. Explain the difference between nutrition claims and health claims. Give each.

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6. Explain how you would advise a consumer to plan their diet using the amounts of carbohydrates, protein, fat and calories.

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Storing food

Correct storage of food can help to prevent spoilage, bacterial contamination an
non-allergens and **allergens**. Spoilage refers to decay and decomposition of foo
or is in the process of decaying may lose some or all of its nutritional value and n

Did you know?

An allergen is a substance, e.g. an ingredient in food such as nuts, dairy or sulphites, which can cause an allergic reaction in susceptible individuals.

D
Am
food
temp

The points to remember for storage are:

- Keep storage areas clean
- Keep food covered
- Keep food stored at the correct temperatures (dry goods s
  stored between 10 °C and 25 °C)
- Keep food stored off the floor
- Keep storage areas dry and free from mould
- Ensure drainage channels run away from food
- Ensure the storage area is lit sufficiently so that damage, sig
  pests or spoilage can be seen on food

Food premises should have the following types of storage are :

- **Dry food areas**
- Refrigerator and **cold store**
- Freezers – check fridge and **temperatures** regularly

When storing f d, r e following:

- Air c late between items stored on shelves
- Corr containers are used
- Stock is rotated (**stock rotation**) properly (**First in, First out**)
- Raw food is kept on the bottom shelves
- Warm food is not put in the refrigerator or **cold store**
- Food is not stored in open tin cans
- Vegetables with soil on, such as potatoes, are stored away from other food in a dark, dry area of the storeroom

Temperature control

Temperature control is necessary for cooked foods such as ready-to-eat foods **(H** through the **DANGER ZONE** temperatures of between 5 °C and 63 °C and will not that will slow down or kill bacteria.

Cooked food should be eaten within:

- two hours – hot food
- four hours – cold food

After this time, the food should be disposed of and not eaten. Food can only be

Acidic conditions, i.e. below a pH of 4.5, help to inhibit the growth of **pathogenic** need to be subject to temperature control due to their acidic nature, or thanks to UHT products.

- However, some foods with a higher pH are subject to temperature contro accordingly.
- It is important to remember that some types of pathogenic bacteria can produce spores which act as a protective barrier.
- Some pathogenic bacteria also produce toxins which cannot be destroyed

During the ripening process, cheese exhibits a low **pH** (acidic) and this helps to prevent growing. However, once cheese has ripened, it should be kept in chilled storage bec acidity drops, allowing growth of bacteria. Bacteria cannot grow in temperatures ab temperatures below 5 °C. This is why it is important to check the temperature of co

✓ Cooked meat should be at least 75 °C in the centre or the thickest part o

✓ Beef steaks and other cuts of whole beef and lamb (only whole cuts and n rare and bloody IF the outside has been properly cooked or sealed to kill

✘ Sausages, burgers, pork and poultry should **NOT** be served or eaten rare the way through the meat and not just on the outside.

Gravy, sauces and soups should be **simmering** to ensure they are cooked. Cooke when it cools down below 63 °C and chilled food is in the **danger zone** when the

Combining hot and cold food together, such as a hot sauce over cold food ca food, either warming it up or cooling it down.

Remember that some foods are not only high-risk foods due to the risk of **patho** potential **allergens** to some people. Remember – alle can kill, even in smal

Temperatures to remember:

Hot food	minimum 63 °C but preferably at least 75 °C in the beef)
Cold food	should be kept at 5 °C or less (chilled food prefera
Reheating food	minimum 75 °C but preferably at least 82 °C
Cooling food	10 °C or lower within 90 minutes
Freezing	-18 °C
Thawing temperature	between 0 °C and 8 °C
Delivered chilled food	should be at a temperature of 8 °C or lower, and f should be at -18 °C or lower

Temperatures and the DANGER ZONE

Microorganisms multiply the fastest at temperatures between five degrees centi
centigrade (63 °C). This is important, as ensuring correct temperatures during st
shelf life of foods.

Danger zone	Human body temperature	Cooking	
5 °C – 63 °C	37 °C	at least 75 °C	at least 75 ° recon

If reheating food to 82 °C will adversely affect the food, then cooking at tempera
two minutes should be sufficient to kill bacteria.

Temperature control is important for m h protein food, such as chicken. Most high-risk food i protein and high in moisture.

you know?

Food can only be reheated once.

Did you know?

Cooked hot food prior to se
be held at temperatures of a

Ambient storage

Ambient storage refers to food stored in sealed containers at room temperature
ambient temperature is referred to as *shelf-stable food* and this usually has a lon
preservation processes and packaging used). To make food shelf-stable and able
temperatures it must undergo various processes, such as dehydration, desiccatio
chemical preservatives), or be subjected to very high temperatures (sterilisation

Refrigeration and freezing

It is important that the temperature of a fridge does not rise above 5 °C. Refrigerator temperature should be regularly checked and if it exceeds the required temperature, your supervisor must be informed, as the food may need to be disposed of and not eaten. To maintain the temperature of a refrigerator, ensure that:

- it is not overstocked
- the refrigerator door is not opened too frequently or for too long
- warm food is not stored in the refrigerator

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According to legal regulations, chilled fo u be stored below 5 °C.

Research

To find c e about food safety, temperatures and storage visit the Gover
Agency w using the redirect URL **zzed.uk/8228-food.gov**

Cooling food

To prevent the temperature from rising above 5 °C, hot or warm food should nev
should instead be cooled as quickly as possible through placing in a large shallow
and stirring to distribute heat.

Because hot food goes through the **danger zone** when it cools down, ensure tha
than 90 minutes to cool down.

To help the cooling process:

- transfer the food to a larger dish
- stir frequently
- use a **blast chiller**
- divide it into smaller pieces
- place the container with the food in cold water
- store it in a cold store or larder

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Defrosting

Frozen food should be defrosted in a chilled area, refrigerator or **cold room** befo
chicken defrosts and thaws, liquid/juices will be released. It is important that de
the BOTTOM shelf to avoid juices dripping onto other fo ms. Some food ite
other container to contain the juices. Most micro wav ave a defrost function
defrost food items that will be cooked i ely, otherwise defrost slowly in a
Meat should be eaten within 24 hour of thawing.

Although y ould never refreeze raw meat, fish or poultry that has been defr
defrosted it cooked first.

Refrigeration and freezing

Frozen food must be kept at -18 °C or lower and thawed following the manufacturer's instructions. **Freezing** at these temperatures slows down the growth of **pathogenic bacteria** and helps prevent spoilage bacteria from causing decay. Once thawed, **HIGH-RISK** food should be cooked at the required temperatures.

Frozen food goes through the **danger zone** when it thaws, so it is important that
not remain frozen as the outside of the food thaws. Some large items of frozen f
slowly over time at room temperature.

Appliance	Temperature
Refrigerators	5 °C or below. Most caterers set their fridge to lower than 5 affected by leaving the fridge door open.
Freezers	-18 °C or below
Note: The temperature of appliances should be checked regularly. If tempe recommended figures, then your supervisor must be informed. Food m of and not eaten.	

Covering food

Correctly storing food is key to ensuring its safety. If raw or ooked food is not packaged, it is best to store it in a lidded box or ve , e.g. with cling film. Covering food is important as it:

- protects the food in que ther foods from contacting each other (so d ents cross-contamination)
- pro ar g juice from dripping onto other foods – this ap pecially to raw meat
- protects the food from oxygen and prevents oxidation
- prevents the food from taking the smell of other products stored in the

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Did you know?

Freezing food at the recommended temperature of -18 °C does not guarantee killed, although at -18 °C bacteria go/remain dormant. Bacteria may still be pr warmth, moisture or food, or a combination of these elements, bacteria start

Check your understanding: Stor

1. Which of the following statements about ambient storage is TRUE?
   a. It is at freezing temperature. ☐ b. It is at boiling tempe
   c. It is at room temperature. ☐ d. It is at human body t

2. To which of the following temperatures should a freezer be set?
   a. -10 °C ☐ b. 5 °C ☐ c. -12 °C ☐

3. HOT cooked food should be eaten within:
   a. 2 hours ☐ b. 1 hour ☐ c. 4 hours ☐

4. Describe two ways in which appropriate packaging supports food safe food.

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6. Explain why temperature control is important when storing and cook

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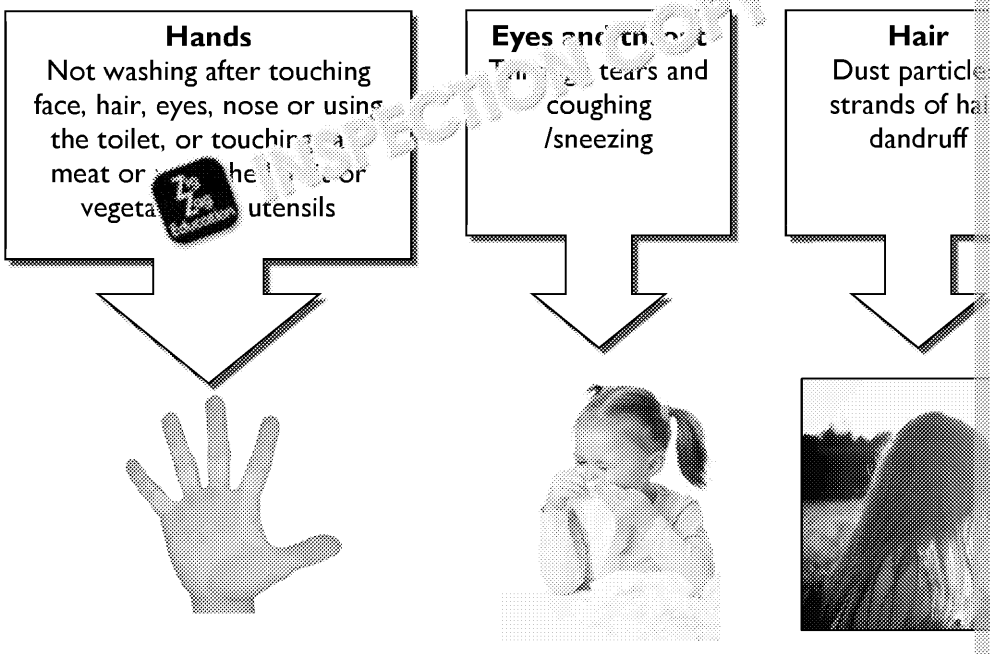
Pathogenic bacteria which find their way into food can cause food spoilage (incre
poisoning (in direct and indirect way). It is very important to distinguish high-ris
microorganisms they can contain, and take appropriate steps when preparing, se
the negative effect of these microorganisms on food and human health.

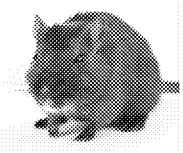
Bacterial contamination

Bacteria can be transferred from people to food in the following ways:



Other ways in which bacteria can be transferred are shown in the table below:

Animals	Dust	Water	Soil
Animals can carry bacteria in their saliva, their urine and in their hair/fur. This includes domestic pets as well as mice, rats and cockroaches and other pests. Animals can transfer bacteria to food in the following ways: mice leaving traces of urine after running a
flies vomit
and alight on food after visiting bins, food waste and excrement.	Bacteria can exist within tiny particles of dust which fall off humans or animals as dead skin cells or from hair or clothes. Dust contains fo
mois
which we may not be able to see when it settles on food.	Untreated water can also contain **pathogenic bacteria**, and some foods, such as shellfish, which feed by filtering water, can becon
co
by
irty water.	Soil also contains **pathogenic bacteria** a
these can b
present in
soil on
unwashed
or vegetab
or on grains
such as rice
pulses.



Sources of contamination

Contamination may occur in the following ways:

- from unwashed fruit or vegetables – soil and dirt
- from raw food – cross-contamination occurs when raw food is stored wi
  high-risk food or when juices or fluids from raw food drop onto high-risk
  Cross-contamination also occurs via hands or utensils if they touch raw f

Bacteria can live on hands, work surfaces, containers, cutlery, utensils and equipment, and towels and cleaning cloths.

When food spoils, it is decaying or decomposing, and this can occur through natural ageing or through microbial contamination with b ria, mould or yeast. Spoilage can be slowed down by preservin d nding food properly and storing it at the correct tem re. Any member of staff who handles food, utensils, work quipment, etc. must practise good personal hygiene a r hands clean.

Types o terial food poisoning

Food poisoning is caused by contamination of food or water with various species different living conditions, and for that reason we can usually guess what type of if we know what a person has eaten. Types of food poisoning bacteria are listed

Type	Cause
Salmonella	Raw or undercooked poultry, eggs, dairy products, raw beansprouts
Staphylococcus aureus	Undercooked or badly stored meat, not chilling sufficiently, eating foods handled by someone infected with *Staphylococcus aureus*
Listeria	Ready-to-eat foods and also soft cheeses
Campylobacter	Raw or undercooked meat (particularly chicken), unpasteurised milk, untreated water
E. coli	Undercooked meat (beef), unpasteurised milk, raw beansprouts
Clostridium perfringens	Undercooked beef and poultry
Bacillus cereus	Rice and other leftover foods left t ol at room temperature

Food poisoning is most likely to b y bacterial contamination from untre and the following raw or y cooked foods:

- Me rti . *coli* – beef)
- Pou rticularly *Campylobacter*)
- Eggs particularly *Salmonella*)
- Seafood
- Vegetables
- Unpasteurised milk (particularly *E. coli* and *Campylobacter*)
- Ready-to-eat foods (particularly *Listeria*)
- Raw sprouted seeds (e.g. beansprouts)
- Cooked rice left to stand at room temperature

Bacterial contamination can occur through the following:

- Not storing, cooking or chilling food properly
- Allowing cooked food to cool down gradually and go through the **danger**
- Not reheating food at correct temperatures to kill bacteria
- Food being touched or handled by someone who is unwell or does not p
- Allowing food to go past its 'use by' dates
- Cross-contamination between cooked and raw food (e.g. fluid from raw

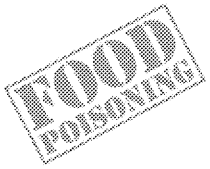
Rice and reheating

Spores containing the bacterium *Bacillus cereus* exist on rice and can cause food poisoning. When left to cool at room temperature, the **spores** multiply and produce toxins. Ideally, leftover cooked rice should not b owed to cool or be reheated but, if necessary, it should be refrige ate a then reheated until piping hot.

Symptoms of bacteri food poisoning

Food poisoning is caused when bacteria grow in large numbers in food, or by viruses transferred from people or animals, or by toxic moulds. Food poisoning can also be caused by poisonous plants and fish or from contamination from chemicals or metals. The symptoms of food poisoning are:

- vomiting
- diarrhoea
- stomach ache and stomach cramps
- high temperature and fever
- aching muscles, chills and weakness



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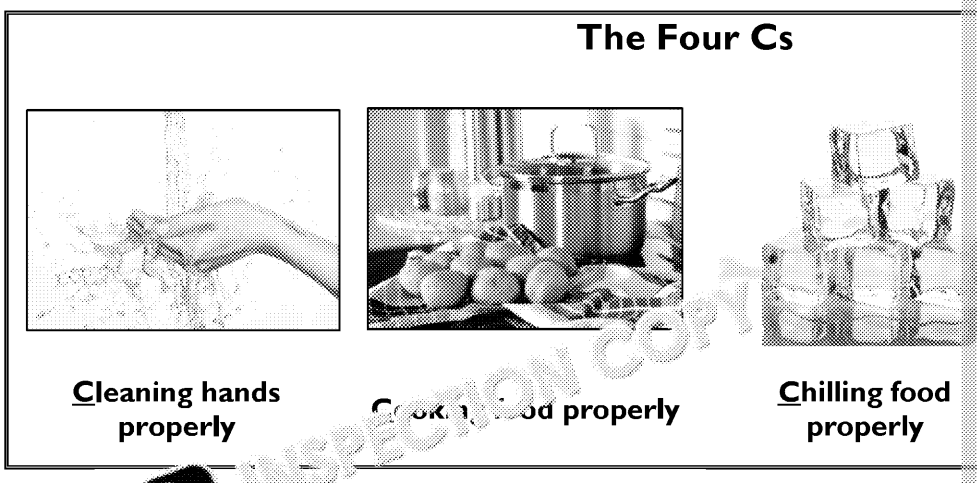
The four 'C's

The Food Standards Agency advise that food-borne illness / food poisoning can b four 'C's of food hygiene: **C**leaning, **C**ooking, **C**hilling and avoiding **C**ross-contami these in the next section.



Resea

Look up food poisoning on the Government's Food Standards Agency website redirect URL **zzed.uk/8228-food-poisoning-2**

Things to think about (3.6)

What is the cause of food poisoning (*E. coli* and *Salmonella*) fro can it be prevented?

Food safety

Food safety is about making sure that food is safe to eat. This means making sur
clean, that food handlers follow effective **personal hygiene** procedures, that foo
that it is eaten within its 'use by' date, that it is cooked or reheated using the **cor**
chilled, thawed or frozen correctly.

To make sure that food is safe to eat, we must make sure that we use the correc
understand the importance of **personal hygiene**.

Unsafe food handling can result in illness or death caused by the following:

- food poisoning
- chemical and physical contamination
- food spoilage
- allergic responses and/or [illegible] shock

The consequ[illegible]s o[illegible]ood hygiene could be:

- cor[illegible]tion claims from customers
- pest[illegible]ats, mice, insects, birds, etc.
- food poisoning / fatalities
- food contamination and wastage
- legal action and closure
- bad publicity on review sites and social media
- loss of profits leading to redundancies

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Environmental health officers (EHOs) have the right of entry and the power to
prosecute if necessary. An EHO can sample and examine food, examine record
and serve notices.

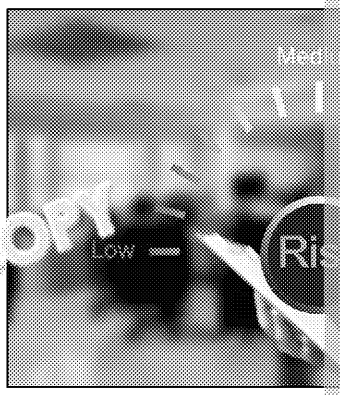
Reporting sickness

To prevent food poisoning or bacterial contamination of food, it is important tha
supervisor. It is a legal requirement to report certain illnesses to the health auth
and management need to be kept informed by their staff.

You must report the following to your supervisor:

- diarrhoea
- vomiting
- sickness and nausea
- ear, eye, nose discharge
- a septic cut, wound or other skin condition
- any other skin condition or infection

You must also tell your supe[illegible] if a[illegible]yone who
lives with you has a[illegible] above symptoms, as
you may be[illegible]er



*You have a responsibility t
maintain food safet*

Things to think about (3.7)

Why are pregnant women at risk from food poisoning?

Personal hygiene

Bacteria can live on hands, **work surfaces**, containers, cutlery, utensils and equip

Any member of staff who handles food, utensils, **work surfaces**, equipment, etc. m
hygiene and keep their hands clean. This means washing your hands:

- before you start work
- before you touch **high-risk** food
- between handling raw food and cooked food, e.g. peeling potatoes and to
- after handling raw food
- after going to the toilet
- after touching any part of your face, body or hair
- after coughing, sneezing, blowing your nose, wiping your eyes
- before and after eating and drinking
- after handling raw eggs in shell
- after performing cleaning jobs or handling containers or chemicals
- after handling waste food waste or rubbish

The hand-washing basin should be used exclusively for hand washing and not be u
There should be liquid soap, hot water and paper (disposable) towels available.

Outdoor clothes are a contamination risk as they can transfer dust, soil and dir
Remember: hair, dust and soil can carry bacteria.

Ideally, to prevent contamination from outdoor clothes, light-coloured protecti
food handling area (light-coloured so any spillages or marks can be seen). A cha
be available for changing from outdoor clothes into protective clothes. Hair sh
with a hat.

What you wear:
To ensure that you do not drop fibres, hair or other foreign objects into food, wear protective clothing or an apron and tie your hair back (if your hair is too short to be tied back, use an Alice band) or use a hairnet or cap to keep your hair in place. Remove jewellery – gemstones from earrings could fall out and land in food, and rings harbour bacteria. Do not wear nail varnish or false nails, and keep nails short and clean.

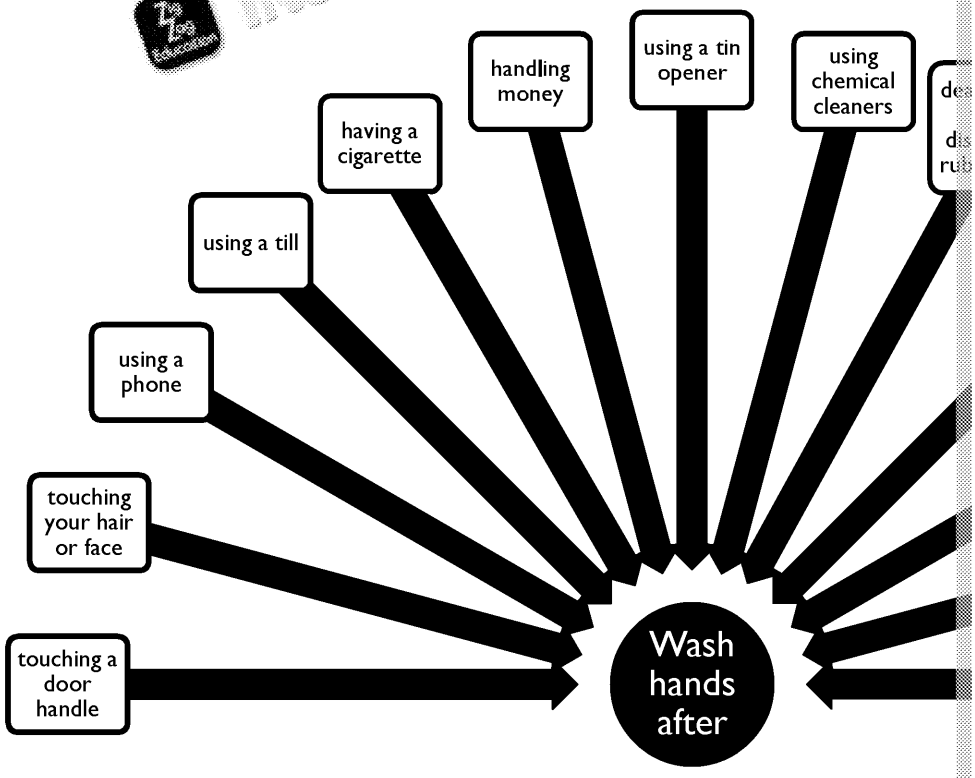
Cuts, boils and rashes:
If you cut yourself, place a bri[illegible]y co[illegible]ured waterproof sticking plaster over the cut. Do not [illegible]s, rashes or boils.

Hand washing:
Wash your hands before and after handling food.
There should be washing facilities provided, with hot and cold water, liquid soap and paper towels. This sink should be used exclusively for hand washing and not be used for washing dishes or vegetables.

Food handling area – dos and don'ts

Do not			
✗	blow your nose, sneeze or cough over food or in the food handling area	✓	go outside the fo… nose
✗	touch any part of your body or face, particularly your nose or mouth and do not scratch your head or touch your hair	✓	wash your hands …
		✓	take your breaks … area
✗	use your finger to taste food – ensure that clean spoons are used for testing purposes	✓	wash your hands …
✗	use a tissue in a food handling area or wipe your nose on your sleeve	✓	wash your hands … part of your body
✗	breathe on glassware to polish it		

You should wash your hands after:



Smokers should remove their protective clothing or … before smoking and also … cannot be transferred to food.

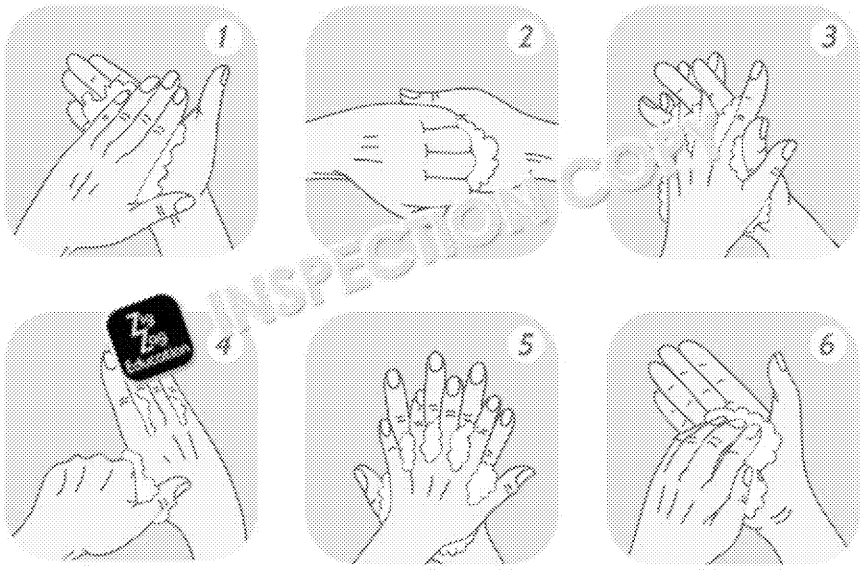
Hands should also be washed after doing the following:

- touching … which have not been cleaned properly
- eating or drinking
- handling raw eggs in their shells

Remember: Wash your hands thoroughly when you start work and before to… food. You must wash your hands between touching high-risk food and raw foo…

Correct hand-washing technique

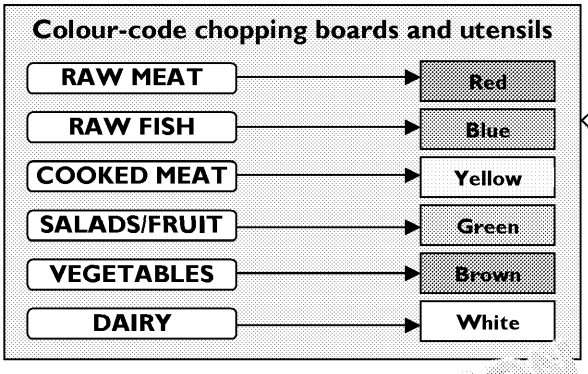
Wet hands thoroughly and add a blob of liquid soap (more hygienic than a bar
rub over backs of hands, rub between fingers and thumb, rub across your nails
Rinse and dry with a disposable paper towel (ensure your hands are totally dry
environment on which to grow). Turn off the tap using the paper towel and th



Cross-contamination

Using separate utensils

Equipment and utensils such as knives and chopping boards should be colour-co
contamination. For example, only use a chopping board and knives that are colo
green for salads and fruit. This helps to prevent bacteria being transferred from



Colour-coding chopping boards and utensils helps prevent cross-contamination

Ensuring that equipment and surfaces are kept clean and free from damage will help to prevent **cross-contamination**.

Clean utensils for chopping raw meat to prevent bacteria transferring from the meat to the board or work surface and utensils. This helps to prevent **cross-contamination** with ready-to-eat foods.

It is important that raw foods and high-risk foods are stored separately so that cr
For example, do not place raw meat on a shelf above other food, especially high-
could drip onto the items stored on shelves below.

Keep stored food covered.

Chicken and poultry should never be washed before cooking as water droplets fr
bacteria onto work surfaces, utensils or food.

Skills

1. Demonstrate knife skills to prevent cross-contamination.
2. Demonstrate washing and drying fruit and vegetables to prevent food
3. Prepare, combine and shape wet mixtures (e.g. falafel, fish cakes, meat
of cross-contamination and correct handling of high-risk foods.

Separating raw and cooked foods

To prevent **cross-contamination**, raw foods such as u ec meat (e.g. chicken
should not be prepared or stored with cook d oc ds e.g. **high-risk** foods such as
rolls.

Other ways to ev n mination:

- Kee covered
- Keep s covered and empty them when required
- Store food safely
- Check for damaged packaging on deliveries
- Keep doors and window screens closed to prevent **pests**
- Clean work surfaces regularly
- Clean up spillages and dispose of food waste promptly

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Checking temperatures

It is important that temperatures of freezers and fridges are checked daily. **Tem**
should be positioned on the outside casing of appliances, such as ovens, refriger
so that temperatures can be seen and recorded easily.

It is also important that **temperature probes** are used to record the temperature
centre (or thickest part) of meat to at least 75 °C or 82 °C if reheated. Temperat
should be recorded. You can also check the temperature of food on the oven ga
is being cooked.

Temperature probes should be calibrated on a regular basis and cleaned after ea

Other ways to test food for readiness and/or to ensure it is safe to eat:

- With a knife/skewer
- Finger or poke test
- Taking a bite
- Visual checking

Thing k about (3.8)

cu s how cross-contamination can occur between different fo

Skills

1. Use a temperature probe (to ensure food is safe to eat).

Skills

1. Use a knife/skewer, bite, sou
poke test to test the readines
ensure food is safe to eat).

Using correct cooking times

We have looked at the correct temperatures at which to cook and reheat food, b
times is also vitally important to food safety, especially when cooking red meat a
reach at least 70 °C for a minimum of two minutes.

Although some foods are safe to be blanched briefly, most foods must be cooke
recommended cooking times to ensure safety.

Lower cooking temperatures can be used so long as the food is cooked for the re
temperature. The core temperature of food should be kept at the following leve

Temperature	Duration
[illegible]	At least 10 minutes
70 °C	At least 2 minutes

Leave food [illegible] for a minute after cooking as the temperature will either sta
thereby killi[illegible]teria.

Cleaning

It is important that food handling areas are kept clean to ensure that **cross-conta**
surfaces should be cleaned frequently by removing food debris and then disinfec

Work surfaces and equipment include:

- Chopping boards
- Preparation areas
- Tables
- Machinery
- Utensils
- Containers

Skills

1. Use a b
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cleanline

Worktops should be smooth and non-porous, and wood should be avoided unless fully washable.

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Disinfection should be performed after cleaning (remove debris and dirt and grease first) and for the correct contact time (as stated on the manufacturers' instructions).

- Detergents dissolve grease and loosen debris – detergents do NOT kill bacteria.
- Hot water at 82 °C or above, such as the high [illegible]eratures in dishwashe
may kill some bacteria, but not all
- Steam can also be used to [illegible] bacteria.
- Sanitisers are a co[illegible] of disinfectant and detergent *but should on*
be us[illegible] for [illegible]led areas.
- Che[illegible]disinfectant (e.g. bleach) is required to KILL bacteria.

Did you know?

Cleaning cloths should be changed after wiping a surface that has been used fo
meat and also after wiping up spills (e.g. raw egg or soil from root vegetables).

Cleaning schedules

Food premises should have a cleaning schedule in place which will detail the follo

- What to clean
- How often it should be cleaned
- Type of cleaning required
- Who is responsible for cleaning

Clean, clean, clean…

- ✓ All areas in a food handling area should be cleaned regularly throughout th special care should be taken on surfaces where raw food or high-risk foods placed. Work surfaces must be cleaned between using them for raw food
- ✓ Temperature probes should be cleaned after each
- ✓ Items that are regularly touched should be cleaned such as handles and sw cleaned after each use for different fo
- ✓ Mops and cloths need to be to prevent multiplication of bacter stored away from fo
- ✓ Bins should be regularly and kept covered, away from food. Outs overnight should be kept covered with tightly fitting lids so as not to a

The correct way to clean

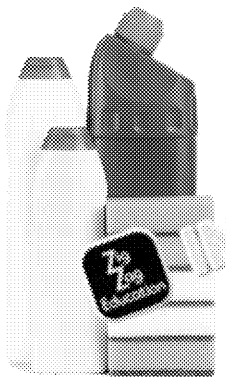
Some food premises use a two-sink method when washing dishes. This enables t debris and to clean dirt and then rinse in a second sink with hot water at 82 °C. T procedure below:

- Remove food debris from soiled areas or from pots and pans and crocke
- Wipe the area or wash with hot water and detergent to remove dirt and
- Rinse the area or rinse items with hot water to remove traces of deterge
- Disinfect the area or items using a chemical cleaner for the prescribed co
- Use a final rinse of clean hot water.
- Avoid using cloths to dry dishes as they may harbour bacteria. If hot wat rinse, then the moisture will evaporate if left to dry in the air.

Taking care

Take care when cleaning and take the following precautions:

- Keep food covered or well away from areas that are being cleaned to pre
- Wear protective clothing, gloves, masks and goggles if necessary.
- Do not mix cleaning agents together – this is **DANGEROUS**.
- Store chemical cleaners, cloths and mops away from food.
- Always wash your hands after cleaning and before you touch food.



Breathing vapours from e detergents can ir

Ch al ers can be a source of skin irrita

Chemical cleaners or vapours can irritate the e

Chemical cleaners (such as bleach) can ruin clo

Research

To find out more about cleaning schedules go to the Government's Food St website using the redirect URL **zzed.uk/8228-food.gov**

Check your understandin
Preparing, cooking and servi

1. Which of the following statements about how bacteria are transferre
   a. Mice and rats can transfer bacteria to food. ☐ b. Domestic pe
   c. Bacteria can exist in dust particles. ☐ d. Bacteria can

2. Which of the following DON'T you need to tell your supervisor abou
   a. Vomiting ☐ b. Diarrhoea
   c. Sickness ☐ d. Toothache

3. Why should light-coloured clothes be worn in the kitchen?
   a. They look nicer ☐ b. So that the public can t
   c. To see spills and marks ☐ d. So that the restaurant's

4. Which DON'T you need to use separate utensils?
   a. Between preparing fruit and salad ☐ b. Between prepari
   c. Between handling raw fish and eggs ☐ d. Between handlin

5. The four Cs represent which of the following?
   a. Cleaning, Cooking, Chilling, Cross-contamination
   b. Cleaning, Cooking, Containing, Cross-contamination
   c. Cleaning, Cooking, Cold-storing, Cross-contamination
   d. Cleaning, Cooking, Chilling, Cross-transferring

6. Identify two preservation methods and describe how each can help to contamination and food spoilage.

   Method 1 .....

   .....

   Method 2 .....

   .....

7. Explain why correct cooking times are important when preparing, co food.

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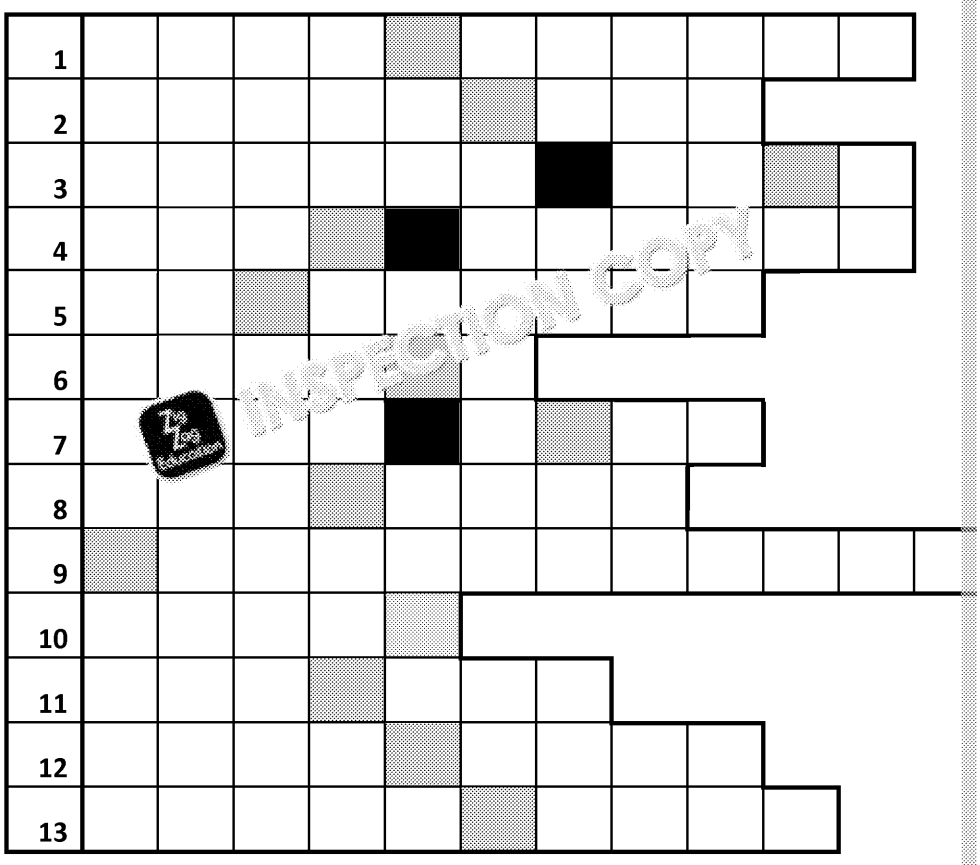
Quiz-ine

Fill in the answers to the questions below to reveal a phrase relevant to food scie
black squares are spaces between words).



1. Type of mould used in the production of blue cheese (11)
2. Dangerous toxin produced by certain mould types (9)
3. Range of temperatures at which microorganisms grow the fastest (6, 4)
4. Date mark which applies to food quality (4, 6)
5. One of the symptoms of food poisoning (9)
6. Protein-based catalyst which speeds up chemical reactions (6)
7. Ready-to-eat foods are referred to as this (4-4)
8. When a food takes the smell of another food product (8)
9. __ sprays often kill 99.9% of bacteria (13)
10. Single-celled fungus used in the production of soy sa[illegible]nd cider (5)
11. Room temperature is also referred to as this (7)
12. The 'bad' bacteria which cause food [illegible]e and poisoning (9)
13. The type of bacteria comm[illegible]ated with eggs (10)

The shaded fi[illegible] re[illegible] word:

Answers

Chapter 1 – Food science

Why and how the food is cooked

Things to think about (1.1)
Examples could include deep-fried foods, such as chips, which are high in fats. To dig has to be produced in the gall bladder, and that puts extra strain on the liver. Modific frying so that the surface of the food is sealed and the food doesn't soak up as much f Also, raw vegetables might be difficult to digest for some people due to high insolubl best to steam or boil them to break down some fibre and impr digestion.

Things to think about (1.2)
1. Students should note that foods w a zen usually have longer date mark as raw fish and fish salad. Student should also note that highly processed, steri labelled with a 'bes e date mark rather than a 'use by' mark.
2. Studen d conclusion that a 'use by' date mark is used on fresh, ea proces d products, while a 'best before' date mark is used on foods whic in a way protects them from external factors and significantly extends thei

Things to think about (1.3)
Examples could include:

	Advantages	
Boiling	– Low-calorie – No added fat – Quick	– Vitamins di when drain – Loss of colo
Steaming	– Preserves the nutritional value of food – Low-fat – Food becomes tender – Hard to overcook	– Can't be use pork, as it w
Simmering	– Develops the flavours – Helps to obtain a desirable texture – Helps to cook the food evenly throughout – Helps to obtain the desired texture, e.g. by evaporating water the food becomes thicker	– Time-consu – Can cause v
Blanching	– Helps to preserve the nutritional value and colour of the food – Quick	– The food do remains ha
Poaching	– Good for preparing delicate ingredients – Helps to preserve the texture of the food – Food remains juicy	– Can't be use instance, as – Vitamins ca then draine
Braising	– Seals the surface so the food remains ju – Improves the texture of the foo	– Time-consu – Causes vita and long co
Baking	– Creates an attr – Develo through dextrinisation and ation proves palatability of food	– Time-consu – Food may e too high or – The long co temperatur
Roasting	– Creates an appetising crust/surface – Helps to lower the calorific value of food as fat melts and leaks out of it	– Causes vita and long co – Time-consu – Can increas extra fat is a
Grilling	– Usually quick – Usually low-fat – Helps to preserve the nutritional value of food	– May create the very hig

	Advantages	
Dry-frying	– Very quick – Helps to preserve the nutritional value of food – Helps to lower the calorific value of food	– Very high te burn very q
Shallow-frying	– Creates a crunchy crust – Helps to obtain an appetising colour – Seals the surface so the food remains juicy	– Increases ca – High tempe
Stir-frying	– Very quick – Helps to preserve the nutritional value of food – Low-fat – The food remains crunchy – The colour of food (e.g. broccoli) is usu[illegible]y preserved	– Can't be use pork, as they
Deep-frying	– Very quick – Provides an a[illegible] golden brown colour – Helps t[illegible] crunchy/crispy texture – S[illegible] surface quickly so the food remains j[illegible]cy – Cheap	– Very high in – High tempe harmful sub – Not suitable fat will spit a – Drastically l of food as th their chemi – Greatly incr

Check your understanding

Q1: A, **Q2:** D (1 mark for each, max. 2 marks)

Q3: Any three from: (max. 3 marks)
- To make food safe to eat
- To prevent bacterial contamination
- To improve/aid digestion
- To improve the texture
- To improve the taste
- To improve the appearance

Q4: 1 mark for each correct (max. 2 marks)
- Radiation (from the heating element in the oven to the baking tin)
- Conduction (from the baking tin to the food inside)

Q5: 1 mark for each correct (max. 3 marks)
- Starch gelatinisation
- Water absorption
- Caramelisation

Q6: Any four from: (1 mark each, max. 4 marks)
- During braising, pork is first shallow-fried, and then stewed for a long time
- Frying helps to seal the surface of the meat
- Frying helps to create an attractive brown colour
- Frying helps to keep the meat moist inside
- Stewing helps to soften and tenderise the meat as [illegible]rotein in it will den
- Long cooking time and high temperature [illegible] vitamin loss (especially sensitive to heat)
- Addition of fat during the [illegible] of braising means that the calorific valu
- Other suitable a[illegible] to be accepted

Carbohydrates

Check your understanding

Q1: B, **Q2:** C, **Q3:** D (1 mark for each, max. 5 marks)

Q4: Any three from: (max. 3 marks)

- Sweetening
- Improving flavour of savoury dishes
- Bulking
- Improving texture through aeration
- Extending the shelf life
- Keeping the food moist
- Speeding up fermentation
- Adding colour through caramelisation and the Maillard reaction
- Or any other suitable answer

Q5: Any four from: (1 mark each, max. 4 marks)

- Starch undergoes gelatinisation in the presence of water and heat.
- At 60 °C starch molecules absorb water and swell.
- At 80 °C the starch granules begin to burst open and release starch to the s
- The more starch there is in the mixture, the thicker it will become.
- During gelatinisation, the starch forms a net-like structure in which water is
- If the mixture overcooks, it will become thin again. This is because if the mi is damaged and the water is released back into the mixture.
- Or any other suitable answer

Fats and oils

Check your understanding

Q1: B, **Q2:** C, **Q3:** B (1 mark for each, max. 3 marks)

Q4: Any two from: (max. 2 marks)

- Whisking
- Beating
- Folding
- Denaturation of protein
- Creaming
- Aeration
- Melting of fat
- Caramelisation of sugar

Q5: 2 marks for a correct description (max. 2 marks)

- If a fat only contains single chemical bonds, it will be both solid at room tem
- The presence of double chemical bonds in fatty acid chains changes the phy monounsaturated fats will be liquid at room temperature, but will solidify w polyunsaturated fats are always liquid.

Q6: 2 marks for a correct description (max. 2 marks)

- Fats (oil in mayonnaise) are hydrophobic and repel water molecules (e.g. fr
- Emulsifiers prevent the mixture from splitting.

Q7: 1 mark for each relevant point from: (max. 4 marks)

- In shortening, fat molecules create a hydrophobic layer around starch mole
- This prevents gluten in starch from coming into contact with the water.
- Gluten cannot form long fibres without water.
- Therefore, the pastry will be crumbly/crunchy/crisp, rather than spongy and el

Protein

Check your understanding

Q1: D, **Q2:** B, **Q3:** C, **Q4:** B (1 mark for each, max. 4 marks)

Q5: 1 mark for each correct function, with or without description (max. 3 marks)

- Glazing – egg wash helps to create a shiny finish on bread rolls and other ba
- Binding – egg acts as a glue in sweet and savoury dishes, such as muffins or
- Coating – egg helps the breadcrumbs stick to the food, preventing them fall
- Raising agent – whisked egg white traps a lot of air and is used in many swe soufflé
- Improving the texture – whisked whole eggs create a foam, which can be us

- Emulsifier – eggs contain lecithin, which is a natural emulsifier; because of t production of emulsion sauces, such as mayonnaise
- Thickener – eggs coagulate in the presence of heat, and, therefore, are used
- Colourant – egg yolks add a yellow shade to batter and other mixtures
- Aeration – egg whites are whisked to create foams/meringues, which are th cake batters and omelettes
- Or any other suitable answer

Q6: Any two from: (1 mark each, max. 2 marks)
- Yeast ferments and produces carbon dioxide.
- Gluten forms a net, which traps air bubbles / carbon dioxide.
- Gluten fibres are elastic and can be stretched.
- This allows the dough to rise.

Q7: (1 mark each, max. 4 marks):
- Proteins denature when heated.
- Proteins coagulate in the presence of s lt f m acids.
- In quiche Lorraine, eggs are b ten poured on top.
- During baking, the pr in t e egg mixture denature and coagulate, tha thick/stable /

Fruit a getables

Check your understanding

Q1: B, **Q2:** B, **Q3:** D, **Q4:** D, **Q5:** B (1 mark for each, max. 5 marks)

Q6: 2 marks for: (max. 2 marks)
- Enzymatic browning is primarily caused by an enzyme (however, oxygen is
- while oxidation is primarily caused by oxygen (no enzymes are needed for t

Q7: 1 mark for a method, 1 mark for an explanation (max. 6 marks)
- **Method**: covering with cling film or putting into a lidded box to shield from
- **Why it works**: oxygen speeds up browning because it bonds with the phen
- **Method**: packaging in modified atmosphere to reduce the amount of oxyge
- **Method**: using proper tools which do not contain copper or iron
- **Why it works**: both of these metals speed up enzymatic browning, so avoid idea
- **Method**: use of an acid such as lemon juice or vinegar
- **Why it works**: enzymes are built from protein, so will denature in the pres
- **Method**: lowering the temperature by putting food into the fridge
- **Why it works**: enzymes are built from protein, so will deactivate at low te
- **Method**: blanching the food to deactivate enzymes
- **Why it works**: enzymes are built of protein, and will deactivate at high tem

Raising agents

Check your understanding

Q1: A, **Q2:** C, **Q3**: D, **Q4**: D (1 mark for each, max. 4 marks)

Q5: 1 mark for each function, 1 mark for each example (max. 4 marks)
- Function: leavening agent / adding nutritional val
- Examples: bread / pizza / baked goods
- Function: fermentation to produce a o.
- Examples: wine/beer/cid
- Function: ferment i prove flavour/digestibility
- Exam les: / empeh / miso

Other s an ers may be accepted.

Q6: 1 mark method and description (max. 3 marks)

Method	How it works
Whisking	Eggs are whisked with sugar to make meringue or sponge cake which air bubbles are trapped.
Beating	Liquids are beaten to make a batter; air bubbles are trapped in
Folding	Air is trapped between layers, e.g. in flaky pastry.
Sieving	Air is trapped between starch particles (but also icing sugar pa
Creaming	Air is trapped between fat and sugar particles in the mixture.
Rubbing in	Rubbing the fat into flour traps the air in the mixture.

Do NOT accept biological or chemical raising agents as answers.

Bonus chapter: the most common faults in cooking and how to avoid them

Check your understanding

Q1: D, **Q2:** C, **Q3:** B (1 mark for each, max. 3 marks)

Q4: Any three from: (max. 3 marks)

- Using too much sugar can cause the cake to sink in the middle.
- Using too much flour or cocoa can cause the cake to be tough and dry.
- Adding too much baking powder / bicarbonate of soda can cause the cake t
- Adding too little baking powder / bicarbonate of soda can cause the cake t
- Adding too much sugar can cause the cake to develop a hard, sugary crust.
- Or any other suitable answer.

Q5: Any six from: (1 mark each, max. 6 marks)

- Bread is made with the use of yeast. Yeast consists of tiny, single-celled fu water to multiply.
- Not adding sugar to the dough means that the yeast has no food, so cannot rise.
- Using the wrong type of flour (e.g. low-gluten) means that the carbon dioxi ke e dough properly, and it will make the bread tough.
- Lack of water in the dough means that gluten will not develop, and the dou
- Using the wrong type of flour, such as gluten-free, means that gluten will n bread will be tough (will not develop the open, sponge-like texture).
- Using old yeast can mean that it is not alive any more, so the dough will no
- Using water that is too hot can kill the yeast in the dough, so it will not rise
- Using water that is too cold will lower the temperature of the dough, and t yeast – the dough will rise very slowly (or not at all).
- Adding too much salt to the dough means that it will compete with sugar fo crust to brown too much (as there will be more sugar to caramelise). A hig yeast growth, and that can cause the dough to rise very slowly – or not at a
- Kneading the dough too vigorously can cause carbon dioxide to escape fro become tough.
- Proving the bread for too short a time (or not proving at all) means that th to multiply and produce a sufficient amount of carbon dioxide, and that wi
- Baking the bread for too short a time can cause it to sink and become toug
- Baking the bread too high up in the oven can cause it to burn on top and cr be raw.
- Or any other suitable answer.

Quiz-ine

1.	Foam	5.	Gluten	9.	Antioxidant
2.	Shortening	6.	Solanine	10.	Stirring
3.	Browning	7.	Denaturation	11.	Microwaves
4.	Thiamine	8.	Carbon dioxide	12.	Steaming

The shaded fields reveal this word: **fermentation**

Chapter 2 – Sensory properti

Sensory evaluation

Things to think about (2.1)
Our olfactory system influences our food preferences. Food smells (in the form of tin
human eye) reach the scent receptors in the nose; the olfactory system transmits the
nose and on to the brain. We then react to the smell by finding it appetising or unapp
molecules can be received by special sensors at the top of the nose. Our sense of sme
blocked nose affects your sense of taste.

Things to think about (2.2)
Controlled conditions are important for taste panels to ensure reliability of the result
ensure that the tester does not become distracted by smells, appearance or sound, an
the food sample.

Check your understanding
Q1: B, **Q2:** A, **Q3:** B, **Q4:** B (1 mark for each, max. 4 marks)
Q5: Any three from: (1 mark for indicating the controlled condition and 1 mark for e
controlled)

- Ta oup – age, sex, physical activity, lifestyle, potentially vegetarians o
  va groups of consumers perceive the product and how the product co
  their needs better.
- Aim of the product – to build up muscles, to support healthy body composit
  from degenerative diseases, etc.
- General rules for how to set up the taste panel – testers can be both experi
  sample should be small in volume (not a whole cup, as this might be too m
  for the tester and explanation how to use it, etc.
- For this product, the taste panel should be consumers of protein drinks wh
  exercise. This is to ensure that the product is assessed by a relevant group,
  likely to buy the product.
- Although gender is not necessarily a criterion for this test, more men than w
  training and are likely to be in the age range of 18 to 50.
- As this is a plant-based drink, the taste panel should contain a proportion o
  probably be the likely consumers, although non-vegans may also buy the p
  in the panel.
- Other correct responses may be accepted.

Chapter 2: Quiz-ine

1. Olfaction
2. Umami
3. Sight
4. Triangle
5. Subjective
6. Organoleptic
7. Ranking
8. Hedonic
9. Preference
10. Star profile

The shaded fields reveal this words: **taste panel**

Chapter 3 – Food safety

Microorganisms (food spoilage)

Things to think about (3.1)
Most at risk are the very young or elderly, people who are already ill or recovering, a
Any individual whose immune system is weaker is more susceptible to the effects of
pass from a pregnant woman to an unborn foetus.

Things to think about (3.2)
This is human body temperature, which creates ideal conditions for bacteria to grow

Things to think about (3.3)
Some foods, such as grapes and tomatoes, show signs of spoi[illegible]ore others as they ca
This is because they provide all the conditions necessary for the growth of microorganism
food (protein and sugar) and temperature (a[illegible]re often stored at room temperature)

Check your understandin
Q1: D, **Q2: C, Q3:** A, **Q[illegible]** mark for each, max. 4 marks)
Q5: Any th[illegible]m: [illegible] mark each, max. 3 marks)
- Ve[illegible]temperatures, such as in freezing, deactivate enzymes, so that enz
conducted.
- Very low temperatures, such as in freezing, make bacteria dormant and ca
they are inactive and do not multiply.
- Low temperatures, such as in a fridge, slow down the action caused by enz
be delayed.
- Low temperatures, such as in a fridge, slow down the growth of bacteria a
in temperatures above 5 °C.
- High temperatures, such as in cooking (above 63 °C) and blanching, deacti
protein and denature due to high temperatures).
- High temperatures, such as in cooking (above 63 °C), kill most bacteria.
- Very high temperatures, such as in sterilisation (above 100 °C), kill all bact
safe at least until it cools down and goes through danger zone again, or unt
contaminated food.

Q6: 1 mark for each correct statement: (max. 8 marks)
- Microorganisms such as *E. coli* and *Campylobacter jejuni* cause food poison
toxic mould present in food or water.
- Pathogenic bacteria can come from raw foods, pests, people, air, dust, dirt a
food, moisture, protein and warmth, bacteria can multiply using a process
- Because pathogenic bacteria cannot be seen or smelled in food, it is possib
poisoning without realising the potential danger.
- Pathogenic bacteria which cause food poisoning are present in humans an
on to other humans through handling food.
- Dust, dirt and soil contain pathogenic bacteria. This is why it is important
- Raw food, such as uncooked chicken, contains pathogenic bacteria which c
at the correct temperatures will kill bacteria, making the food safe to eat.
- Bacteria are not killed when raw food is froze[illegible]ain dormant until it
chicken, isn't thawed and then cooked [illegible]ne correct temperatures,
becoming a potential food poiso[illegible].
- The danger zone for fo[illegible]s b[illegible]een the temperatures of 5 °C and 63 °C. If
temperatures (th[illegible]one) then bacteria can start to grow and divide
pr[illegible]a [illegible] food poisoning risk.
- Ti[illegible]um conditions for bacteria to grow are warmth, time, moisture a
foo[illegible]ept for long enough at room temperature, it will develop bacteria
- Cooking food at the correct temperatures can kill pathogenic bacteria. Foo
may start growing bacteria. In some people this may only cause a slight ga
may be fatal. The elderly, the very young or those who are ill or recovering
from food poisoning due to compromised immune systems. Unborn babies
so pregnant women should take care.
- Food poisoning can be caused by storing food incorrectly. Raw food and h
separately to ensure that cross-contamination does not occur, e.g. raw chic
fridge to prevent juices dripping onto other food items.

- Food poisoning can be caused by pathogenic bacteria from raw food being t surfaces or chopping boards to other foods.
- Food poisoning can be caused by eating cooked rice which has been left to c
- Food poisoning can be caused by pathogenic bacteria present in milk and da cooked meat and poultry, with the biggest risk being when raw and high-risk
- Food poisoning can be caused by harmful toxins called mycotoxins which e toxic and some can be used in food production.

Microorganisms (food production)

Things to think about (3.4)
There is a wide range of products made with the use of fermentation. These include c other baked goods made with the use of yeast (e.g. traditional ba a brith cake), as wel champagne. Many alcoholic beverages are produced thr ei nentation, e.g. beer,

Check your understanding
Q1: B, **Q2:** B, **Q3:** B (1 mark for ea a arks)
Q4: Any two from: (1 mark ar 2 marks)
- Bacteria tr r e lactose in milk and produce lactic acid.
- L d l wers the pH of the milk and causes the protein in milk to coag
- Co on of milk causes the curds to separate from the whey, which can

Q5: Any four from: (1 mark each, max. 4 marks)
- Before mincing, the meat is partially frozen to kill potential parasites (*Trich*
- Before mincing, the mincing machine and all utensils used are sterilised to k
- Mincing takes place at low temperatures to slow down the growth of micro
- Starter cultures of bacteria and moulds are added.
- Bacteria produce lactic acid, which lowers the pH of the sausage and slows
- Mould creates a coat on the outside of the sausage and shields it from the a
- Drying reduces the amount of water in the sausage, so bacterial growth is s

Other suitable answers may be considered.

Buying food

Things to think about (3.5)
Storage rotation is important so that food with a short shelf life is used before food w stored accordingly, with items with a short shelf life stored in front of items with a lo

Check your understanding
Q1: A, **Q2:** B, **Q3:** B, **Q4:** A (1 mark for each, max. 4 marks)
Q5: 1 mark for definition and 1 mark for example (1 mark each, max. 4 marks)
- **Nutrition claim** is a statement which refers to the content of an ingredien
- Examples could include: source of protein, low-fat, contains vitamin C or n
- **Health claim** is a statement which shows the direct link between consump health benefits.
- Examples could include: helps to lower blood cholesterol levels, supports s to boost immunity.

Q6: Any three from: (2 marks for each, max. 6 marks)
- Advice would be based on an individual's l s vl d now active they wer BMI.
- The Recommended Intak f a a rage male or female would be used to individual requir s a l nced, healthy diet.
- For e mp l an averagely active woman with a vegan lifestyle who 2, or a day to meet her energy needs.
- Sh lso require 70 g of fat from a healthy source, consisting of 50 g fr oil and avocado, and 20 g from saturates such as milk or dairy products.
- Carbohydrates (from which she will also derive natural sugars) should be f grains, beans and peas, with at least 50 g of protein being provided by sou soya.
- As part of this diet, Sian will not consume more than 6 g of salt per day.
- Sian's diet ensures that her calories come from approximately 50% carboh

Storing food

Check your understanding

Q1: C, **Q2**: D, **Q3**: A (1 mark for each correct, max. 3 marks)

Q4: 1 mark for identifying, 1 mark for explaining why it is efficient (max. 4 marks)

- Sealed bags and containers protect the food inside from the air – conseque and oxidation cannot happen.
- Closed boxes and bags protect the food inside from pests and microorganis material, so the food cannot be spoilt.
- Packaging protects the food inside from sunlight – so that the vitamins do value of the food is maintained.
- Packaging contains information about the food – so that the consumer can them, e.g. free from allergens or free from gluten.
- Packaging contains a date mark, which says wh e food is fresh and w point in time.
- Packaging protects from leakage the leaking juice, e.g. from meat, d products in the shopping n the fridge.
- Packaging can b o maintain cool temperatures, so that the food mic not multiply.

Other answers may be accepted.

Q6: Any fou (1 mark each, max. 4 marks)

- Chicken is a high-risk food which is high in protein and high in moisture. T warmth, provides ideal conditions for bacteria to thrive.
- The correct temperature to cook chicken is at 75 °C or higher. If reheating but preferably 82 °C. Cooking or reheating below these temperatures allow
- For storage, chicken should be frozen at -18 °C (this will slow down bacter regrow during the thawing process).
- Frozen food such as chicken goes through the danger zone when thawing, s ensure that the inside thaws while the outside of the chicken thaws. This m need thawing slowly at room temperature, which can necessitate the food a period of time. Cooking at the correct temperature will kill the bacteria.
- Temperature control is important when dealing with thawed chicken. Alth refrozen once thawed, poultry that has been defrosted can be refrozen if co temperatures.
- Temperature control is important when storing or defrosting raw chicken that the temperature of the appliances is at 5 °C or lower and that warm fo to prevent the temperature from rising. Temperatures above 5 °C put the c bacteria can start to grow and multiply.
- Cooked chicken which is served cold should be kept cool and eaten within bacteria can start to grow and multiply, and it should be disposed of.
- Hot food, such as cooked chicken, must be held at temperatures of at least
- Combining hot and cold foods can affect the temperature of food, either wa This can affect the temperature of cooked chicken, such as cooling it down start growing.
- Food such as chicken is a high-risk food that carries the risk of bacterial fo reheated once.

Things to think about (3.6)
Food poisoning can be caused when bacteria grow in large numbers in food or by vir
animals or by toxic moulds. Food poisoning from bacterial contamination of untreat
insufficiently cooked can be the cause of *E. coli* and *Salmonella*. Beansprouts are gro
temperature conditions (i.e. between 5 °C and 63 °C), this can enable bacteria to gro
conditions). Because of the danger from food poisoning, beansprouts should only be
or otherwise should be steamed or cooked until piping hot. Raw beansprouts should

Things to think about (3.7)
Pregnant women can transfer food poisoning to their unborn babies. This can have s
sometimes lead to miscarriage.

Things to think about (3.8)
Cross-contamination between salad items and chicken can occur from soil on unwas
grow on cooked chicken. Utensils, such as chopping boards and knives, can transfer
important to use separate utensils when preparing raw and cooked food.

Check your learning
Q1: B, **Q2:** , **Q4:** A, **Q5: A** (1 mark for each, max. 5 marks)
Q6: 1 mark each method indicated, 1 mark for description of why is it efficient (m
- Bottling – air is removed from the bottle; bacteria are killed during cooking
- Vacuum packing – air is removed from the package, so aerobic microorgan
and enzymatic browning is stopped
- Pickling – in brine, probiotic bacteria produce lactic acid, which creates an
bacteria from multiplying; in vinegar, acid denatures proteins and prevents
- Freezing – low temperature slows down the enzymatic action, and causes l
lowers water activity, so there is no water available for microorganisms to
- Jam making – high sugar content acts as a preservative and prevents bacte
lids kills bacteria and spores; cooking the jam helps to kill microorganisms
- Or any other suitable answer

Q7: Any four from: (1 mark each, max. 4 marks)
- The core temperature of food should be kept at the correct level for the rec
- Although some foods are safe to be blanched briefly, most foods must be co
recommended cooking times to ensure safety. Lower cooking temperature
cooked for the recommended duration for that temperature.
- Food should be reheated at the correct temperature to kill bacteria. In son
temperatures may adversely affect the texture or taste of food, it can rehea
the required duration (e.g. red meat should reach at least 70 °C for at least
- Cooking food at the correct temperatures is important for prevention of ba
stand for a minute after cooking can also help to kill bacteria as temperatu
rise within this time.
- Cooking at the correct temperatures can help to kill bacteria but some food
recommended temperatures of at least 75 °C. The following durations mus
temperatures: at least 45 minutes at 60 °C, at least 10 minutes at 65 °C and
- Gravy, sauces and soups should be simmering to ensure that they are cook
This means that, after boiling, the heat should be reduced so that cooking co
for the prescribed amount of time.
- Some foods should be cooled rapidly to prevent bacterial growth with
can be done using a chiller to cool food rapidly by circulating very col

Chapter Quiz-ine

1. *Penicillium*
2. Mycotoxin
3. Danger zone
4. Best before
5. Diarrhoea
6. Enzyme
7. High-risk
8. Tainting
9. Antibacterial
10. Yeast
11. Ambient
12. Pathogens
13. *Salmonella*

The shaded fields reveal this word: **contamination**